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SAFE USE

OF AGRICULTURAL AND HOUSEHOLD PESTICIDES

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PREFACE

Safety in the use of chemical pesticides is a major concern in a world that must control food-destroying pests in order to provide enough food for its rapidly multiplying population.

In the United States it is evident that we must continue to use chemical pesticides. There is no alternate means of adequately controlling most of the rodents, insects, mites, nematodes, weeds, fungi, and other pests that take heavy toll of our Nation's agricultural production. It is estimated that nearly a third of our potential production is lost to these pests despite our use of pesticides.

Pesticides are used by farmers primarily to protect their crops and livestock. They are used by people in all walks of life to protect their health, comfort, and property. They are essential to our national economy and well-being.

Pesticides can be poisonous to humans, domestic animals, pollinating insects, or wildlife if they are not properly used. But pesticides can be safe if they are used for their prescribed purposes and as directed by competent authorities. The precautions and procedures by which they may be used safely on the farm and in the home are discussed on the following pages.

This reference work has been prepared to aid farm advisers, county agricultural agents, extension home economists, and others who carry out the educational activities of the U.S. Department of Agriculture. Each chapter is written to present its information in sufficient detail to minimize the need for cross-reference; thus, for the convenience of the user, several safety recommendations are repeated in different chapters.

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SAFE USE OF AGRICULTURAL AND HOUSEHOLD PESTICIDES

FARM PRECAUTIONS

The population of the United States is increasing at the rate of 3 million persons each year; it is expected to double in the next 35 years.

To feed new multitudes of Americans, farmers must increase their output progressively year by year. They must control the destructive pests that otherwise would seriously curtail farm production. To control the pests, they must use chemical pesticides.

Observance of the following precautions will insure safe use of pesticides on the farm.

Selecting Pesticides

1. Select a pesticide recommended for a specific use by a competent authority. This authority may be a county agricultural agent or adviser, a specialist from an agricultural college, or a current publication of a State experiment station or extension service or of the U.S. Department of Agriculture.¹

2. Select a formulation that is effective against the pest to be controlled and suited for safe application with the equipment available.

3. If there is a choice between using a coarse spray or a dust, select the spray to reduce drift hazards. The average particle size of dusts is considerably smaller than that of most sprays; dusts,

therefore, tend to drift considerably farther than sprays.

4. Select granules if they are as effective and as economical for your purpose as a spray or a dust. Granules rarely create a drift problem. However, granular pesticides may remain active in the soil longer than other forms of the same materials.

5. Where possible, purchase wettable powders, emulsifiable concentrates, or dusts in containers of such a size that one or more containers can be entirely used for each tank charge; this eliminates the hazard of handling and storing partly filled containers.

6. When there is a choice of formulations of a pesticide, consider these relative hazards:

- An oil-soluble formulation is usually more hazardous to operators than a water-soluble formulation; it is more easily absorbed through the skin.

- Formulations that are not completely soluble are less hazardous than water-soluble or oil-soluble formulations.

Storing Pesticides

1. Store pesticides in their original containers; *never transfer a pesticide to a food or beverage container.*

2. See that the labels remain on stored containers.

3. Store pesticides in a dry place where they can-

¹ For general recommendations on the selection of insecticides, see Agriculture Handbook 313, "Suggested Guide for the Use of Insecticides To Control Insects Affecting Crops, Livestock, Households, Stored Products, and Forest Products," available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price \$1.

not be reached by children, animals, or unauthorized persons.

4. Never store both poisonous and harmless chemicals in the same place. To do so increases the danger of mistaking a poisonous chemical for a harmless one.

5. Do not store herbicides or defoliants near insecticides; if you do, cross contamination may occur.

6. Remove from storage only the amount of material needed for 1 day's application.

Disposing of Empty Containers and Unwanted Pesticides

Empty containers and unwanted pesticides can be serious hazards if they are not disposed of properly. Safe disposal can be accomplished as follows:

Empty Containers

1. Before disposing of large containers, empty remnants of pesticide into a pit dug in level sandy soil, in a place where they cannot contaminate water sources. Rinse the containers with water after emptying.

2. Do not convert empty drums or barrels into livestock feed troughs, water-storage tanks, or raft floats; they could be sources of feed or water contamination.

3. Dispose of large metal drums in one of these ways:

- Return them to the supplier.
- Sell them to a firm dealing in used drums or barrels that is equipped to neutralize the toxicity of adhering materials. Contact your pesticide deal-



Figure 1.—Chopping holes in pesticide container to prevent its reuse.

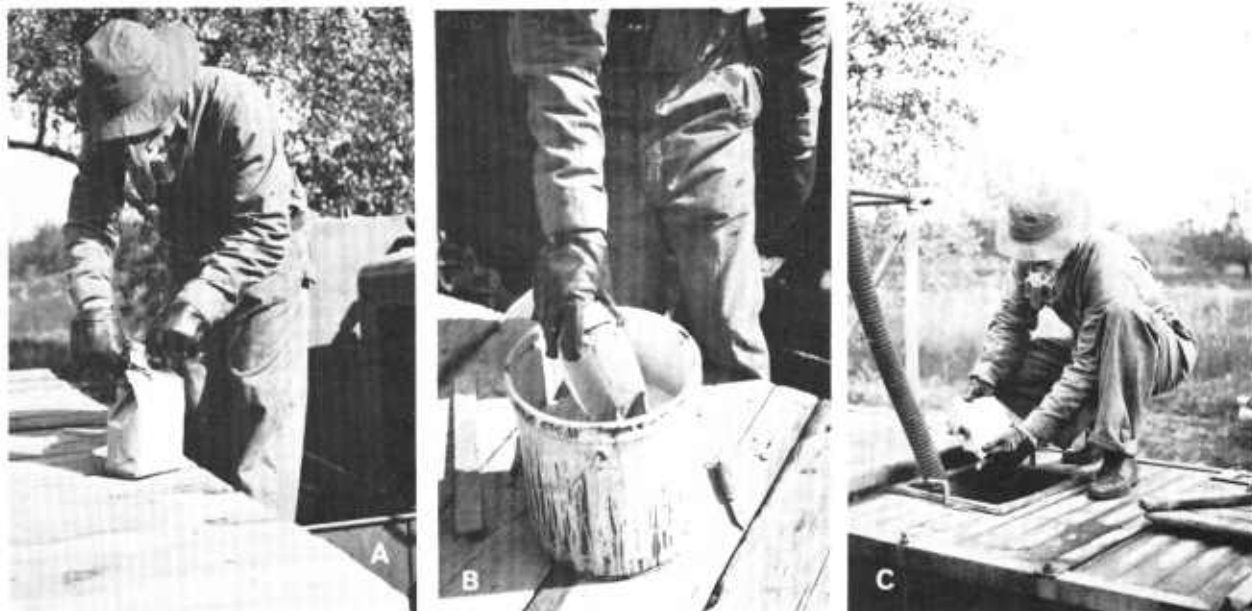


Figure 2.—Safe way to open and pour a bag of wettable powder: A, Operator cuts bag near top to prevent spillage; B, he holds bag low in receptacle to prevent billowing or blowing of powder; C, when pouring powder into spray tank, he holds bag low and pours slowly.

er for the names and addresses of such firms in your area.

- Take them to a sanitary land-fill type of dump. Inform the operator of the dump that the drums contain residues of poisonous materials; warn him that poisonous vapors may be produced if the containers are burned. Before leaving, remove lids or bungs from the containers; chop holes in the containers with a sharpened pickax to prevent reuse (fig. 1).

- If none of the preceding disposal means are available to you, find a private disposal site that you will use only for empty containers and unwanted pesticide. Select a site away from homes, streams, ponds, pastures, and cropland; be sure it is not on the watershed of a public or private water supply.

4. Deposit small containers at a public dump, or bury them at least 18 inches deep at a private disposal site. First remove the caps or lids; punch holes in metal containers; crush glass containers.

5. Burn combustible containers, *except herbicide containers*, unless the container label warns against burning. Do this when the wind will not cause contaminated smoke to drift over nearby homes, people, livestock, crops, or the person doing the work. **Caution:** Some municipalities have restrictions against burning; consult local authorities before burning containers.

6. Dispose of herbicide containers as follows:

- Do not burn them. When herbicides or defoliants volatilize, the resulting vapors may be poisonous to humans, and they may damage nearby plants, crops, or shrubbery. Herbicides or defoliants containing chlorates may explode when heated.

- Break glass herbicide containers. Chop holes in top, bottom, and sides of metal containers so they cannot collect water or be reused, or crush them under a tractor wheel or with an ax or sledge hammer. After breaking or puncturing them, bury the containers at a depth of 18 inches or more at a safe disposal site, or take them to a dump that does not burn its refuse.

Unwanted Pesticides

First, offer to give unwanted pesticides to a responsible person in need of the materials. If this is not practicable, bury dry pesticides at a depth of at least 18 inches in a safe disposal site. Pour liquid pesticides into a pit dug in sandy soil. Do not take unwanted pesticides to an incinerator.

Mixing and Handling Pesticides

1. Mix and prepare pesticides in the open or in a well-ventilated place. When handled in close quarters, highly toxic pesticides may cause poison-

ing through inhalation. If the pesticides are volatile liquids, they may cause fires or explosions.

2. Open pesticide containers carefully to prevent billowing of dusts or splashing of liquids.

3. Pour pesticides carefully to avoid spilling. Hold the container from which you are pouring close to the receiving container. (See fig. 2).

4. Use special containers—drums or pails—for mixing pesticides; *never use food or beverage containers.*

5. Never use your mouth to siphon a pesticide from a container.

6. Do not mix pesticides in concentrations higher than those recommended. Measure accurately. These practices will help insure the application of correct and safe dosages.

7. Avoid spilling concentrates on the skin or clothes, and keep them away from the eyes, mouth, and nose. If any is spilled, wash it off the skin with soap and water and change contaminated clothing immediately. Launder contaminated clothing before wearing it again.

8. If pesticide gets into the eyes, flush the eyes with plenty of water for 5 minutes; call a physician.

9. If pesticide is swallowed, apply the first-aid treatment printed on the container label. Telephone a physician. If you cannot reach a physician, telephone the nearest hospital for further instructions. (See "What To Do If Chemical Poisoning Occurs," pp. 19 to 33.)

10. Always wear rubber gloves when handling concentrates. Rinse the gloves well with water before removing them; do not turn gloves inside out when removing.

11. To safely mix and prepare some pesticides, it is necessary to wear a respiratory device and protective clothing. The container label will tell if these precautions are needed.

12. Do not smoke, eat, or drink when mixing pesticides.

Applying Pesticides

1. If the container label prescribes it, wear a respiratory device and protective clothing when applying a pesticide. (See "Respiratory Devices and Protective Clothing," pp. 12 to 18.)

2. Do not apply dosages greater than those recommended on the container label.¹

3. Time your applications to prevent illegal pesticide residues from remaining on food, feed, or forage crops; allow the prescribed number of days' interval

between the last pesticide application and harvest or grazing.¹

4. Guard against *drift* of pesticides onto nearby crops, pastures, or grazing livestock, or onto streams, ponds, lakes, or other fish-bearing waters. Do not dust or spray on a windy day.

5. Guard against *runoff* of pesticides into sources of water supply. Do not apply pesticides near dug wells, cisterns, or any other water sources into which they may run or be washed by rain. Do not clean application equipment, dump unwanted pesticides, or dispose of empty containers near these places.

6. When applying spray or dust, work into the breeze or at a right-angle to it; thus the pesticide will be blown away from instead of onto you. If this is not practicable, wear a respirator.

7. Do not smoke, eat, or drink while actually applying pesticide. Suspend the operation and thoroughly wash hands and face before doing any of these things.

8. Be careful not to rub eyes or mouth with your hands during applications.

9. If you should feel ill while applying pesticide, stop work at once and get medical attention.

10. At the end of a day's work, bathe and change all clothing. Launder the clothing before wearing it again.

11. If your shoes are leather and have become heavily contaminated with a pesticide that can be absorbed through the skin, do not wear them again; burn or bury them. It is impossible to efficiently decontaminate leather shoes. Rubber shoes may be washed with soap and water.

Protecting Livestock

The residues of some chemicals—pesticides and drugs—can accumulate in animal tissues. Some chemical residues remain in the bodies of livestock a long time; other chemical residues are soon broken down and eliminated.

Prevent the presence of illegal amounts of pesticide or drug residues in the meat of slaughtered livestock; very few tolerances have been established

¹ For detailed information on recommended amounts of insecticide to apply, and the number of days' interval to allow between the last application and harvest or grazing of crops, see Agriculture Handbook 313, "Suggested Guide for the Use of Insecticides To Control Insects Affecting Crops, Livestock, Households, Stored Products, and Forest Products," available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at \$1 a copy, or refer to State publications containing this information.

for such residues. Avoid residues in milk; *there is no legal tolerance for any chemical in milk.*

Observe these precautions:

1. Use only pesticides or drugs that are registered or licensed as suitable for your specific purpose.
 2. Treat animals only with the pesticides or drugs recommended for their specific needs by a competent authority (county agricultural agent or adviser, specialist of a State agricultural college, veterinarian, or a current publication of a State experiment station or extension service or of the U.S. Department of Agriculture).
 3. Allow the recommended interval between the last pesticide application and harvest or grazing of feed crops.
 4. Do not feed cannery wastes, trimmings from vegetable packing houses, or other food byproducts to livestock unless you have ascertained that these materials do not contain pesticide residues that will carry through into the meat or milk.
 5. Place covers over feed and water containers when applying pesticide near or on areas occupied by livestock.
 6. After treating dairy cows with antibiotics or other drugs, withhold their milk from the market for the length of time specified by the veterinarian or by the instructions on the container label.
 7. After treating animals with pesticides or drugs, allow the prescribed interval (stated in number of days) between the last treatment and slaughter. Refer to the container label for this information.
 8. Keep insecticides thoroughly mixed when applying them to livestock. Otherwise some animals may receive too much of the active ingredient for safety, or too little for adequate pest control.
 9. Do not spray or dip recently weaned calves when the weather is bad; the exposure may kill them.
 10. When treating cow barns or milk rooms for insect control, use only chemicals labeled for this purpose. Follow the label directions precisely.
 11. Be sure to clean spraying equipment, including hose, before using it for spraying cattle or other livestock.
 12. When preparing back rubbers, don't use burnt motor oil. Top oils and valve oils usually contain poisonous materials that get into the crankcases of motors and contaminate the burnt oil that is available from garages and filling stations.
- When any of the following insecticides are applied to dairy cows or beef animals by means of back rubbers, stop the treatment no later than the

indicated number of days before freshening or slaughter:

<i>Applied to dairy cows:</i>	<i>Days</i>
Ciodrin, 1 percent.....	0
Methoxychlor, 5 percent.....	14
Ronnel, 1 percent.....	21
<i>Applied to beef animals:</i>	
Ciodrin, 1 percent.....	0
DDT, 5 percent.....	30
Dioxathion, 1½ percent.....	0
Malathion, 2 percent.....	0
Methoxychlor, 5 percent.....	0
Ronnel, 1 percent.....	42
Toxaphene, 5 percent.....	28

14. After spraying animals with insecticide be sure the animals are thoroughly dry before allowing them to wade in ponds, lakes, or streams.
15. Do not use a spray or dip if an oily or gummy film appears on its surface after it has been mixed; the chemical may have deteriorated and consequently the active ingredient may not be evenly distributed in the mixture.

Caring for Equipment

1. For efficient and safe application, keep equipment in good mechanical condition. Replace parts promptly when they show signs of wear or malfunction. Give special attention to valves, nozzles, tubing, connections, and other components that may cause leakage.
2. Calibrate the equipment accurately¹ so it will dispense the prescribed amount of pesticide per acre. Underdosage from faulty calibration would be ineffective against the pests you are trying to control; overdosage could be a prime cause of illegal residues.
3. If possible, use separate equipment to apply different types of pesticides. A minute herbicide residue in a tank loaded with insecticide could seriously damage susceptible plants; also, insecticide residue in a herbicide tank could cause ill effects.
4. If it is necessary to use the same equipment for several types of pesticides, clean it thoroughly be-

¹For instructions on the calibration of application equipment, see Agriculture Handbook 313, "Suggested Guide for the Use of Insecticides to Control Insects Affecting Crops, Livestock, Households, Stored Products, and Forest Products," available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at \$1 a copy, or refer to State publications containing this information.

tween changes. Different cleaning procedures are required to remove different pesticide residues from application equipment, as follows:

Herbicides.—If a sprayer has contained herbicide, clean it by one of the following two methods:

- Thoroughly flush the tank with warm water and a detergent. Then fill it with a solution of 1 part household ammonia in 100 parts of water. Run some of the solution through the sprayer boom and nozzles. Allow the solution to remain in the equipment for 12 to 24 hours, then remove it and rinse the equipment with water.

- Rinse the tank for about 2 minutes with a 0.25 percent suspension of activated charcoal ($\frac{1}{4}$ pound of activated charcoal in 10 gallons of water) to which has been added a small quantity of a household detergent. Run some of the suspension through the boom and nozzles. Empty the tank and rinse with clean water.

Neither of the above methods is always completely effective. To test the equipment after cleaning, fill it with water and spray seedlings of a sensitive plant such as bean, tomato, or a sensitive weed. If the plant is not affected within 2 days, the equipment is safe for further use.

Wettable powders.—Rinse the tank with water containing a wetting agent or a detergent; then rinse with plain water.

Dusts.—Remove as much of the residual dust as possible. Then fill the hopper with plain talc, clay, or other inert material. Empty the hopper. Repeat this procedure if necessary.

Emulsions.—Flush the tank with large quantities of water, with agitator running. Rinse once or twice with an oil solvent (paint thinner or herbicidal naphtha). Flush again with water, and drain.

Solutions.—Rinse with the same kind of solvent used in the formulation previously contained in the tank; if this was an organic solvent, you may use paint thinner, herbicidal naphtha, or fuel oil. Drain the tank and rinse with soapy water. Rinse again with plain water.

RESPONSIBILITY FOR ILLEGAL RESIDUES IN MILK

The *owner* of milk as it is marketed is held responsible for any pesticide residues in the product. The *producer* also is held responsible, even though he had no direct control over the pesticide applications from which the contamination resulted. If a pesticide residue is detected in milk, the milk may be condemned and the producer may be told that milk from his cows may not be marketed until a residue is no longer present.

If the owner or producer markets milk containing illegal residues in interstate commerce, the milk is subject to Federal seizure and the shipper is subject to prosecution and injunction. The Food and Drug Administration collects and analyzes milk samples by very sensitive equipment capable of detecting and measuring minute amounts of residue. Some States are also equipped to make such analyses. The Food and Drug Administration notifies State officials and owners when residues are found. State officials halt shipment of the contaminated milk and maintain surveillance over the producing farms until the residue problems are corrected. Both Federal and State agencies emphasize preventive measures.

NEMATOCIDE PRECAUTIONS

Handle nematocides with great care. Follow the manufacturer's directions exactly. Variations in soils or climate may affect the action of nematocides. Ask your county agricultural agent or State agricultural experiment station for advice as to the best method of application in your area, and the avoidance of possible harmful effects. For detailed information on the use of nematocides, see Agriculture Handbook 286, "Chemical Control of Plant-Parasitic Nematodes," available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; price 15 cents.

HOME AND GARDEN PRECAUTIONS

Housekeepers and home gardeners frequently face the problem of controlling insects and other pests that contaminate food, destroy property, injure garden produce, or cause personal annoyance. Some of these pests, at times, cannot be controlled without using pesticides.

If not handled and applied properly, many pesticides used in the home or garden can injure people or pets. Most pesticide poisonings occur to children under 5 years of age. And most of the poisonings, whether to adults, children, or pets, are caused by carelessness. They can be prevented.

Pesticides, *if carefully used*, will give satisfactory pest control in the home and garden without endangering anyone. To insure safety, housekeepers and home gardeners should strictly observe the following precautions.

General Precautions

1. *Read the label.* This is the first rule of safety in using any pesticide—*read the label and follow the directions and precautions printed on it.*

2. Store pesticides in closed, well-labeled containers where children or pets cannot reach them. Do not store them under the sink, in the pantry, or in the medicine cabinet. Do not store them near food of any kind.

3. Store application equipment as you do pesticides—out of the reach of children or pets. Label each duster or sprayer with the name of its pesticide contents.

4. Do not save or reuse empty pesticide containers. Dispose of containers promptly as follows:

- Do not puncture pressurized containers. Do not burn them; they may explode and cause bodily injury or start fires.

- Wrap the empty containers, including bags and cartons, in heavy layers of newspaper or other paper. If you have trash-collection service, deposit them with the trash for removal. If you do not have this service, crush metal containers and break glass containers; take them to a public dump, or bury them at least 18 inches deep at a place where they will not contaminate water sources.

5. Do not apply more pesticide than the label recommends. Overdosage is wasteful and may be dangerous.

6. If you use poisoned bait to control rats, mice,

or other pests, either indoors or outdoors, place it where children or pets cannot find it.

7. When opening a liquid pesticide container, keep your face away from, and to one side of, the cap or lid.

8. Mix or prepare dusts or sprays outdoors or in a well-ventilated room.

9. In handling *any* pesticide, avoid contact with the skin. Do not get pesticide near your mouth, eyes, or nose.

10. If pesticide gets in your eyes, flush the eyes with water for 5 minutes; get medical attention.

11. Never smoke, eat, or drink while handling a pesticide. After finishing the work, wash exposed skin surfaces with soap and water.

12. If you spill pesticide on your clothing, launder the clothing before wearing it again.

13. If you become ill during or shortly after using a pesticide, call a physician immediately.

14. If you accidentally swallow some pesticide, call a physician at once. From the container label, read to him the names of the active chemical ingredients; follow his instructions for first-aid treatment. (See "What To Do If Poisoning Occurs," pp. 19 to 33.)

Home Precautions

In addition to the preceding *general precautions*, housekeepers should observe the following precautions to insure the proper and safe use of pesticides in the home.

1. Apply each form of pesticide for its proper purpose:

Surface sprays.—These sprays have coarse particles that dampen or wet the surfaces to which they are applied. When the spray dries, a thin deposit of pesticide remains. The deposit usually is invisible.

Buy surface sprays in pressurized containers; or buy a liquid insecticide and apply it with a household hand sprayer that produces a continuous coarse spray.

Space sprays and aerosols.—These two forms of sprays are designed for application into the air. They are effective against flying insects, and also may be used to penetrate the hiding places of other insects and drive them into the open where they may be killed with a surface spray or dust.

The particles or droplets of a space spray are

finer than those of a surface spray, and float in the air for a time. The particles of an aerosol are finer than those of a space spray, and float in the air for a longer time.

Do not apply a coarse surface spray into the air of a room; it may be hazardous if so applied. Use a space spray or aerosol that is designed and labeled for this purpose.

Dusts.—Pesticidal dusts usually contain the same active ingredients as sprays. They are used for surface applications, and may be blown by a household hand duster into cracks, corners, and other places hard to reach with sprays.

Poisoned baits.—As the name implies, poisoned baits are materials on which a pest will feed, to which a poison has been added. They are used to control rodents such as rats and mice and some other pests. Poisoned baits are applied by placing them where they will be encountered by the pest to be controlled.

2. Some sprays sold in pressurized containers may be labeled for both surface and space applications. If you use one of these products for spraying in the kitchen or pantry, first place cooking and eating utensils, and food, where they will not be contaminated by falling particles of spray.

3. Some people are allergic to the materials in space sprays and aerosols. If you find that you are allergic to a particular pesticide formulation, select another formulation suitable for the purpose.

4. Do not use inside the house any pesticide that requires a respirator or gas mask in its application.

5. Keep children away when you are applying pesticide.

6. Do not spray entire floors, walls, or ceilings with pesticide. This would be wasteful, and would leave residues where they would come in contact with human beings or pets.

7. Keep persons and pets out of treated rooms until the rooms have been aired.

8. Remove aquariums, and birds, cats, dogs, and other pets, and their food and water bowls before spraying or dusting.

9. When spraying, dusting, or dipping pets, use only a pesticide labeled for the purpose.

10. Unless the container label states otherwise, assume that all prepared sprays are flammable. Do not spray near an open flame. Turn off gas pilot lights before spraying. Do not smoke while spraying.

11. Sometimes fumigation is needed to rid a house of rodents, termites, bed bugs, or other pests. Fumigation should be done *only by a professional ex-*

terminator or other experienced person.

Occupants must leave a house before it may be fumigated, and they should not return until the fumigated house has been thoroughly aired. Airing usually requires from 24 to 48 hours, the time depending on the type of fumigant used. The entire operation—fumigating and airing—requires from 2 to 4 days.

Garden Precautions

The information that follows applies to both flower and vegetable gardening. It is fundamentally the same advice given for commercial farming (pp. 1 to 6).

The difference between home gardening and commercial farming is basically in scope. The householder usually pursues his gardening as a hobby. He cultivates a small piece of ground—a backyard or a lot—for pleasure rather than profit. He is usually not physically exposed to pesticides for long periods. He may handle pesticide concentrates that are very toxic before being diluted for application, but he does not—or should not—handle, mix, apply, or store on his premises the extremely toxic chemicals that are often used in commercial farming.

In addition to the *general precautions* (pp. 7, 8), the home gardener should observe the following:

1. When mixing or handling concentrates, wear rubber gloves. Rinse them well with water before removing.

2. Use special containers for mixing pesticides. Never use food or beverage containers.

3. Apply a pesticide only on the plants for which it is recommended. Apply it only against the specific pests it is designed to control. The container label will tell.

4. Do not apply dosages heavier than those recommended on the container label.

5. Do not apply dust or spray on a windy day. When there is a breeze, apply the dust or spray from the windward side of the area being treated, so the breeze will blow the pesticide away from you, not onto you.

6. Do not allow pesticides to drift onto adjoining property. Do not apply pesticides near wells or cisterns or any other water sources into which they may run or be washed by rain. Do not clean application equipment, empty unwanted pesticide, or dispose of empty containers near these places.

7. To prevent harmful residues from remaining

on edible plants, it may be necessary to allow a waiting period between the time of the last pesticide application and the time edible parts of the plant are picked. The length of the waiting period varies for different pesticides on different plants. Read the container label for this information.

8. Do not apply pesticide to a lawn when people or pets are on it. After treating a lawn to control soil pests, sprinkle it with water to wash the pesticide from the grass into the soil. This will reduce the hazard to children and pets; it will not reduce

the effectiveness of the treatment. Do not allow children or pets on the lawn until the grass has dried.

How large can a home garden be? It can be as large as a small farm if there is enough land around the house. When your gardening expands to the point where you use power equipment and are exposed to pesticides for long periods, refer to "Farm Precautions," pp. 1 to 6, for safety information applicable to such conditions.

SAFE AERIAL APPLICATION

Application of pesticides by aircraft has developed into an extensive, skilled profession. Various hazards are associated with the work; they can be minimized by observance of the precautions given in this handbook.

Commercial pest-control operators teach their employees the principles of both safety and efficiency. They provide supervision to insure that these principles will be observed during operations. Some agricultural colleges and commercial schools offer short courses in efficient, safe aerial application of pesticides.

The personnel of most aerial application companies are familiar with safety precautions that must be taken in their work. The information given here is addressed primarily to *farmers*—to acquaint them with the protective services to which they are entitled when they contract for professional pesticide application.¹

Generally, safety measures in aerial application relate to four major areas: (1) Dispersal equipment precautions, (2) ground crew precautions, (3) pilot precautions, and (4) management and supervision.

Dispersal Equipment Precautions

Safe operation cannot be achieved or maintained without the proper equipment. Consider these recommendations:

1. The aircraft is the most important item of equipment. Use the type of aircraft best suited

for the job. Fixed-wing aircraft are usually more practicable than other types for treating large areas where the swath runs are long. Helicopters are safer and more maneuverable for treating small areas, or plots, particularly those in which there are obstacles.

2. Protect pilots, and increase operating efficiency, by using aircraft specially designed for pesticide application. These aircraft are equipped with numerous safety features, including:

- Special ventilation that reduces pilot exposure to chemicals.
- Provision for pilot comfort, to reduce fatigue.
- Good visibility in all directions.
- Ease of control during slow flight; partial aileron control during stalls.

3. If you apply spray with a fixed-wing aircraft that has boom-and-nozzle equipment, see that the boom length is not more than three-fourths of the wingspan. If the boom is longer and extends close to the wingtips, the spray will be picked up by the wingtip vortices and may drift outside the treatment area.

4. See that the dispersal equipment has a positive-cutoff valve that will prevent leaking when you shut off the spray at the end of the runs or when flying over pastures, ponds, lakes, streams, or other sensitive areas. A valve that incorporates the suck-back feature also reduces the risk of dribbling nozzles.

Ground-Crew Precautions

1. Each member of the ground crew—whether mixer, loader, or flagman—should have available goggles, respirator, rubber gloves and boots, and

¹ For detailed information on aerial application equipment and operational efficiency, see Agriculture Handbook 287, "Aerial Application of Agricultural Chemicals," available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, at 20 cents a copy.

an extra set of coveralls. He should have access to a shower or an adequate supply of soap and water.

2. Wearing protective clothing and a respirator may be optional with members of the ground crew if they are handling materials no more toxic than 2, 4-D, DDT or malathion, or mixtures of them. Ground crews should wear full protective equipment and take all other reasonable precautions when working with materials as toxic as endrin or parathion.

3. Ground-crew personnel should change clothing and bathe at the end of each day's work, or immediately if a concentrate or highly toxic mixture gets on the skin.

4. Members of the ground crew should learn to recognize symptoms of pesticide poisoning. These symptoms are often more obvious to others than to the victim himself; any abnormal action may indicate the onset of poisoning. The personnel should know what to do in emergency. (See "What To Do If Chemical Poisoning Occurs," pp. 19 to 33.)

5. If water is drawn from streams or ponds for mixing purposes, make sure that no pesticide flows back into the water source.

6. If pesticide is spilled while it is being mixed or loaded, clean it up or otherwise protect persons or animals from coming in contact with it. On a hard-surfaced area, hosing the spot thoroughly with water will reduce hazard. If pesticide is spilled on bare ground, cover it with earth.

Pilot Precautions

The pilot bears a greater responsibility for safe operation than other members of an aerial application team. He must be alert to conditions that might affect him personally; and he must guard against drift and other hazards that could, in one way or another, injure humans, livestock, crops, or wildlife.

Personal Protection

Applicator pilots usually experience less actual exposure to pesticides than do personnel of the ground crew. This is not so under certain conditions. For personal safety, pilots should observe these precautions:

1. Anticipate greater than normal hazard—

- When the pesticide being applied is highly concentrated or very toxic.

- When applying any of the organic phosphorus compounds; exposure to these materials may cause rapid impairment of vision.¹

- When fatigue results from flying for long periods.

2. Do not assist the ground crew in mixing or loading pesticides. Stay on the windward side of these operations to avoid inhaling toxic fumes or dusts.

3. Before takeoff, make certain there are no pesticide leaks or spillage inside the aircraft. These could endanger you during the time required to disperse the load.

4. If you are to be exposed to high concentrations of pesticide, wear a full-face gas mask; or wear a pilot's supplied-air respirator of the type illustrated on page 17. If you prefer to wear goggles, use a type that will seal tightly with a half-face gas mask around the nosepiece.

5. When applying dust formulations, make sure there is no leakage of dust into the cockpit.

6. When protection of the hands is required, wear cloth work gloves. Wear them only while they remain dry, and wash them thoroughly after each day's use.

7. Always wear a crash helmet and shoulder harness during flights.

8. Learn to recognize symptoms of pesticide poisoning. They may include dizziness, blurred vision, watering of the eyes, or nausea. Stop flying when you first notice what might be a symptom. Do not resume flying until all possible symptoms have disappeared and their cause has been eliminated.

9. Bathe at the end of each day's work, and send your work clothes to be laundered before using them again.

Drift Control

Precautions to control the aerial drift of pesticidal dusts or sprays are largely the responsibility of the pilot. Drift cannot be prevented entirely, but it can be reduced to the point where it will do no appreciable harm. Following is the basic information on aerial drift control:

1. Dusts tend to drift much farther than coarse sprays. If there is a choice between using a dust or a coarse spray, use a spray. Granular material is less likely to drift than either a dust or a spray.

2. Coarse spray droplets do not drift as far as fine spray droplets. Use the coarsest spray that will give effective and economic coverage. Oil-

¹ If your work requires the application of organophosphates, take blood cholinesterase tests at regular intervals. Before you first handle the material, take a test to determine your natural cholinesterase level.



Figure 3.—Ground-crew members of aerial application team wear protective clothing while handling highly toxic pesticide.

spray droplets tend to drift farther than water-spray droplets.

3. Reducing the height of flight will reduce the extent of drift. Fly the aircraft at the lowest height compatible with effective dispersal of pesticide and safety of operation.

4. High wind velocity makes it impossible to control drift. If increasing wind velocity creates a drift hazard, stop application immediately.

5. Calibrate dispersal equipment precisely. Adjust it to produce the desired dosage at the predetermined speed of the aircraft. If flow rates should be changed by diluents, additives, or other causes, adjust the calibration accordingly.

6. Under some conditions, a very high temperature prevents the pesticide from settling to the ground within the treatment area. If this situation occurs, postpone applications.

7. In uneven terrain, even on a calm day, the "downhill" movement of surface air can carry spray or dust a considerable distance outside the treatment area. Make allowance for this air movement.

8. Do not make aerial applications to fields or plots so small that drift to adjoining areas is unavoidable. Ground equipment should be used to treat these small areas.

9. Take particular care to prevent drift onto homes, barns, streams, lakes, ponds, or pastures. Make your swath runs parallel to these places; do not make turns over them.

Other Pilot Precautions

1. Do not prime the dispersal equipment or test

the flow rate while ferrying between the airstrip and the area being treated.

2. After completing a job, do not dump pesticide remaining in the aircraft while returning to the airstrip. Instead, return to the airstrip, drain the unused pesticide into a properly labeled container, and store it in a safe place. If you must dispose of excess pesticide, dust or spray, bury it at least 18 inches deep in a disposal site where it can do no damage.

3. See that the aircraft and its equipment are cleaned daily; the cleaning prevents pesticide from accumulating. Do this cleaning where the drainage will soak into the ground; select a place from which the drainage will not run into a sewer, ditch, pond, or stream.

Management and Supervision

Managers or owners of aerial application firms, and their operation supervisors, have distinct responsibilities for insuring safe operation. An individual applicator who has only one aircraft and a few helpers must himself assume the same responsibilities.

Managers or owners should—

1. Equip the aircraft with all safety devices needed to protect the pilot, prevent leakage of pesticide, and reduce drift.

2. Equip the aircraft with adjustable dispersal apparatus that produces the desired droplet size, deposit pattern, and application rate.

3. Provide safe, up-to-date loading equipment. This is essential to the safety of the ground crew;

it can add greatly to the efficiency of operation.

4. When pilots or other workers are exposed to organophosphates, make it mandatory for them to take blood cholinesterase tests at prescribed intervals.

Operation supervisors should—

1. Make sure all workers understand the nature of the chemical being handled, and what to do if poisoning occurs.

2. Do these things before starting an operation:

- Get in touch with a physician and a hospital in the area; describe the work being done and the chemical being used, so that, if there is an emergency, they will know what treatment is needed.

- Post the names of the physician and the hospital at the mixing site.

3. Require all members of the ground crew to wear the necessary protective clothing.

4. If a pilot or any of the crew shows signs of poisoning, see that he gets medical attention at

once; remove him from contact with toxic material for at least a week.

5. When highly toxic chemicals are being handled, assign at least two men to assist each other in the work, and to watch each other for symptoms of overexposure to the materials.

6. Clear the treatment area of people and animals before starting applications. Notify beekeepers so they can take measures to protect their colonies. See that precautions are taken to prevent people or livestock from entering a treated area until it is safe for them to do so. Inform residents near the treatment area of any precautions they need to take before, during, or after applications.

7. Provide for the safe disposal of empty pesticide containers. When carelessly discarded, these containers are a menace to humans and animals. (See "Disposing of Empty Containers and Unwanted Pesticides," p. 2.)

RESPIRATORY DEVICES AND PROTECTIVE CLOTHING

People who work with pesticides—in their manufacture, packaging, or application—depend for their personal safety on respiratory devices and protective clothing. Respiratory devices prevent inhalation of toxic dusts, vapors, or gases; many of them also protect the eyes or the entire head. Articles of protective clothing prevent pesticides from contacting the skin, and should be worn whenever it is necessary to handle pesticides that may be absorbed through the skin in harmful amounts.

Respiratory Devices

Two kinds of respiratory devices—*chemical-cartridge respirators* and *gas masks*—are most generally used to prevent the inhalation of pesticides. A third kind, *supplied-air respirators*, is also used.

Chemical-Cartridge Respirators

Most chemical-cartridge respirators are designed as half-face masks that cover the nose and mouth but do not protect the eyes (fig. 4). They have one or two cartridges attached to the facepiece by a

holder. The cartridges contain a chemical, usually activated charcoal, that adsorbs¹ toxic vapors or gases.

Respirator facepieces are equipped with one-way valves that allow air for inhaling to enter through the cartridges but prevent the moist, exhaled air from venting through them.

All chemical-cartridge respirators approved by the U.S. Department of Agriculture are equipped also with filters that remove dust and spray particles.

Gas Masks

Most gas masks are designed to cover the entire face and protect the eyes. Their facepieces are made to hold a chin-type canister or connect to a chest-type canister by means of a flexible hose. A chest-type canister may be fastened on either the chest or back of the operator by straps. (See figs. 6 and 10.)

Canisters serve the same purpose for gas masks as cartridges do for respirators, but gas-mask canisters contain more of the poison-removing materials and therefore have a longer service life.

Because they fit more closely, full-face gas masks will not leak as easily as half-face masks or respirators.

¹ The activated charcoal contained in respirator cartridges *adsorbs* the molecules of vapors or gases by *holding them to its surfaces*. The chemicals other than charcoal contained in gas-mask canisters usually *absorb* these gases or vapors by "swallowing" them, or *taking them inside*.



Figure 4.—Chemical-cartridge respirator equipped with two cartridges.



Figure 5.—Full-face gas mask equipped with chin-type canister.

Supplied-Air Respirators

A supplied-air respirator is one in which pure air, under pressure, is delivered through a flexible tube to the operator's mask. There are two types—the constant-flow type, and the demand-flow type.

Constant-flow type

Some constant-flow respirators provide, under steady pressure, air that has been purified by having been drawn through a filter and canister before being delivered to the operator's mask.

Other constant-flow respirators do not have a filter or canister, but supply pure air that has been forced to the operator's mask from an uncontaminated source.

Some constant-flow respirators are available in units that can be mounted on tractors or other application equipment (fig. 7). These units operate on 6- to 24-volt direct current or 115-volt alternating current.

Demand-flow type

A demand-flow respirator, like the constant-flow type, delivers pure air to the operator. It differs, however, in that the air flow is not constant; it is

alternately off and on. When the operator exhales, the flow stops; when he inhales, it starts. Usually the air is supplied from a compressed air tank or cylinder. This type of respirator employs a full facepiece connected to a "demand" valve that regulates the start and stop of the flow (fig. 8).

A demand-flow mask connected to a compressed-air cylinder is satisfactory for short-period use. Cylinders are available in several sizes. The most common size contains 22 cubic feet of air—enough for 15 to 20 minutes of service.

Length of Service Life

Respirators and gas masks are dependent, respectively, on cartridges and canisters for their effectiveness. The cartridges and canisters must be replaced when their absorbent or adsorbent capacities become exhausted.

Cartridges and chin-type canisters usually have shorter service lives than chest-type canisters because they contain less of the chemical material. Different types give service for various lengths of time. The U.S. Bureau of Mines requires that a gas-mask canister have a service life of at least $\frac{1}{2}$ hour when used by an operator performing mod-

erate exercise in gas concentrations up to 2 percent.

The service life of these devices is affected by humidity, temperature, and the volume of the operator's breathing. High humidity shortens the service life, in use or in storage. Mists, sprays of water, and rain also shorten the service life.

Tests by the U.S. Department of Agriculture have shown that cartridges or canisters in storage gradually lose their effectiveness because of exchange of air within the units; this exchange is caused by changes in temperature and atmospheric pressure.

Uses of Respiratory Devices

Respiratory devices should be purchased and used *only for the specific purposes for which they are designed*. Some of these devices are limited in the range of their effectiveness. For example, a cartridge or canister that protects against certain specific pesticides may not protect adequately against

mixtures of the same pesticides. However, several available devices will give protection against all the commonly used pesticides.

Further information on this subject is available in a publication entitled "Respiratory Devices for Protection Against Certain Pesticides." If you wish a copy, write to the Entomology Research Division, Agricultural Research Service, Beltsville, Md., 20705; ask for ARS 33-76-1.

Uses of chemical-cartridge respirators

Generally, chemical-cartridge respirators are used for protection against dusts or mists during the field handling of pesticides. They do not give adequate protection to an operator handling highly concentrated pesticides.

The label on a pesticide container will tell if the protection of a respirator or gas mask is needed.

Chemical-cartridge respirators are generally worn by operators engaged in the following work:

1. Handling pesticides during the loading of application equipment.
2. Disposing of pesticide containers or unwanted pesticides.
3. Work in which the operator is exposed *for only a short time to small amounts* of highly toxic pesticide.
4. Field work in which the operator is exposed continuously during the day or for successive days to pesticides *in amounts so small that they are almost undetectable*. Exposure to appreciable amounts requires the use of a gas mask or a supplied-air respirator.

Uses of gas masks

Because they are equipped with canisters and with facepieces that fit more closely, gas masks give greater protection than chemical-cartridge respirators. They should be used by operators engaged in the following work:

1. Formulating or mixing pesticides in closed or poorly ventilated places. Full-face gas masks should be used; chemical-cartridge respirators *do not* give adequate protection against inhalation of pesticidal dusts, mists, or vapors under these conditions.
2. When applying fumigants to grain. Follow instructions of the fumigant manufacturer. When concentrated fumigating material is applied directly to the surface of grain, there may be very high concentrations of gas close to the air inlet of the gas-mask canister if it is mounted on the operator's chest. Thus, gas concentrations in the intake air



Figure 6.—Full-face gas mask connected by flexible hose to canister mounted on operator's chest.



Figure 7.—A constant-flow, supplied-air respirator protects the operator of this spraying rig.

may be reduced by mounting the canister on the operator's back (fig. 10).

3. Applying highly toxic pesticide by aircraft. A full-face gas mask is recommended. If a half-face gas mask is used, the goggles must seal tightly with the mask around the nosepiece.

4. Any work that directly exposes the operator to *concentrated* dusts, sprays, or aerosols—as in greenhouses, in closed places, or at the rear of a power-driven rig.

5. Dusting or spraying under tobacco shade cloth, or in citrus groves in hot or calm weather.

Uses of supplied-air respirators

Supplied-air respirators are generally used by operators who work in grain elevators, ship holds, the inside of tanks, or other places where the natural supply of oxygen in the air is low or where high concentrations of pesticides are in the air.

Lightweight, supplied-air respirators that have full-face masks are available to pilots engaged in aircraft application (fig. 13).

Protective Clothing

In conjunction with respiratory devices, which prevent inhalation of pesticides, protective clothing

is used to prevent contact of pesticides with the skin.

Skin contact can occur with any form of pesticide—dust, liquid, spray, aerosol, or vapor. To be effective, protective clothing must be made of materials that prevent or greatly resist the penetration of any of these forms. Also, the materials must be washable because the clothing should be washed thoroughly after each use to remove the toxic elements that have been kept from reaching the skin of the wearer.

Protective Clothing Requirements

The amount of protective covering an operator needs is determined by (1) the toxicity, concentration, and vapor action of the pesticide he is working with; (2) the degree of his exposure; (3) the length of exposure; and (4) the extent to which the pesticide can be absorbed through the skin. Requirements vary in a number of details; these are some examples:

1. An operator applying concentrated aerosol in a greenhouse (a closed area) is greatly exposed. He should wear complete covering—hood, coveralls, rubber gloves, and boots or washable shoes. He

requires a full-face gas mask equipped with a canister and fume-type filter. (See fig. 11.)

2. An operator applying a toxic chemical inside a tank should wear the same protective clothing described above. He requires a supplied-air respirator. (See fig. 9.)

3. An operator spraying in a citrus grove should wear a rain hat or hood, raincoat, washable gloves, and washable shoes. He may use a chemical-cartridge respirator or a gas mask.

4. An operator dusting or spraying a field crop should wear a hat, coveralls, washable gloves, and washable shoes. He may use a chemical-cartridge respirator.



Figure 8.—Demand-flow, supplied-air respirator. Flow of compressed air from cylinder is regulated by a valve; the flow starts when the operator inhales, and stops when he exhales.

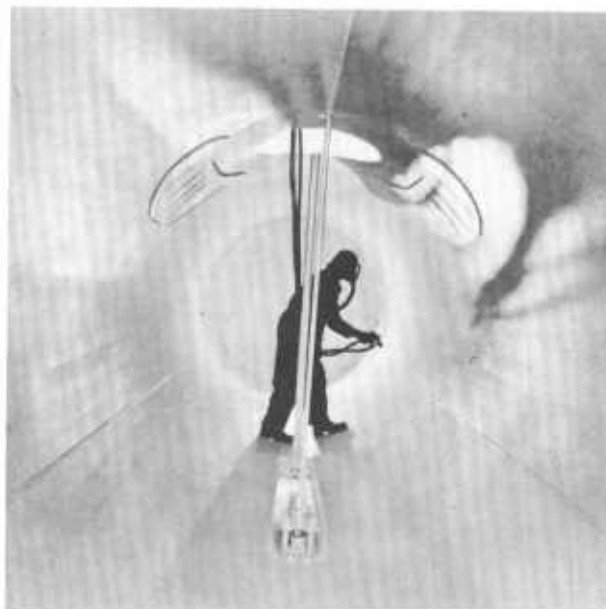


Figure 9.—Spraying inside a tank. Operator uses a supplied-air respirator and wears a complete outfit of protective clothing. This equipment is also used when fumigants are applied in ship holds and other close quarters.



Figure 10.—Operator uses gas mask while applying fumigant to grain. The canister is mounted on the operator's back where the intake air is not highly contaminated by the fumigant.



Figure 11.—Applying aerosol in a greenhouse. Operator wears a full-face gas mask, rubber hood, rubber gloves, and washable coveralls. Rubber boots are worn inside the pants.



Figure 12.—This head and shoulder covering (hood) seals tightly around the gas-mask facepiece; it protects skin areas that the mask does not cover.

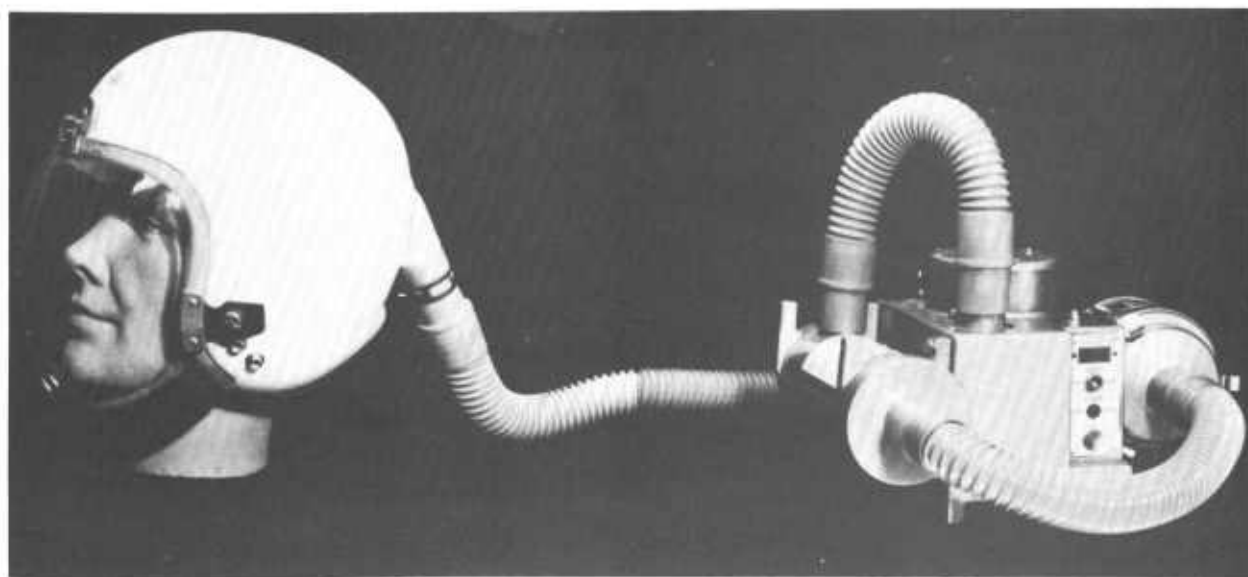


Figure 13.—Light-weight, supplied-air respirator designed for use of pilots engaged in aircraft application of pesticides.



Figure 14.—Two types of protective clothing: *L*, Hat, jacket, pants, and rubber boots worn inside pants; *R*, hat, full-length raincoat, and rubber boots.

WHAT TO DO IF CHEMICAL POISONING OCCURS

If a person becomes poisoned by a chemical, his life may depend on *prompt treatment*. **Call a physician immediately** and give the proper first-aid treatment indicated in the following table.

First-Aid Treatments

Follow these procedures for finding the proper first aid treatment to give for chemical poisoning:

1. In the first column of the following table, find the commonly used name of the chemical that caused the poisoning.

2. In the second column, opposite the name of the chemical, find the *type* of poisoning to which the victim was exposed. The types are: *Internal* (when the chemical has been swallowed), *external* (when

it has come in contact with the skin), *inhalation* (when it has been inhaled), and *eye* (when it has come in contact with the eyes).

3. In the third column, opposite the type of poisoning, find the number of the proper treatment.

4. At the bottom of the following page, under TREATMENT, find the corresponding number and follow the directions.

5. If the victim has been exposed to more than one type of poisoning (by swallowing plus skin contact, for example), apply the indicated treatment for each type.

Table 1.—First-aid treatments for chemical poisoning

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Acetone	Internal....	①	Alpha naphthylthiourea	Internal....	①
	Inhalation..	⑥		Inhalation..	⑦
	Eye.....	⑦	Amiben	Internal....	①
Acrylonitrile	Internal....	①	Amitrole	Internal....	①
	Inhalation..	⑥	Ammonium nitrate	Internal....	①
Aldrin	Internal....	①	Ammonium sulfamate	Internal....	①
	External...	⑤	AMS	Internal....	①
	Eye.....	⑦	Aramite	Internal....	①
Allethrin	Internal....	①		External...	⑤
Allyl alcohol	Internal....	①	Arsenic compounds, inorganic insoluble	Internal....	①
	External...	⑤		External...	⑤
	Inhalation..	⑥			
	Eye.....	⑦			

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

FIND PROPER TREATMENT AT BOTTOM OF FOLLOWING PAGE

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Arsenite desiccant	Internal----	①	Benzene	Internal----	①
	External---	⑤		Inhalation--	⑥
	Inhalation--	⑥		Eye-----	⑦
Arsonate, calcium propyl	Internal----	①	Bidrin	Internal----	①
	External---	①		External---	⑤
Arsonates, except calcium propyl arsonate	Internal----	①		Inhalation--	⑥
				Eye-----	⑦
Atrazine	Internal----	①	Binapacryl	Internal----	①
Barban	Internal----	①		External---	⑤
	Eye-----	⑦		Eye-----	⑦
Benefin	Internal----	①	Boric acid	Internal----	①
	Eye-----	⑦			
Bensulide	Internal----	①	Bromacil	Internal----	①

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

TREATMENT

Apply the treatment whose number corresponds to the number in the third column of the table, opposite the type of poisoning to which the victim has been exposed.

① Induce vomiting by giving victim a tablespoon of salt in a glass of warm water. Repeat treatment until vomit fluid is clear. Have victim lie down and keep warm and quiet until a physician arrives.

② Do not induce vomiting. Give victim large quantities of milk, or whites of eggs beaten in water.

③ Give victim a cathartic—2 tablespoons of Epsom salt in water, or milk of magnesia in either milk or water.

④ Give victim a stimulant—plenty of strong tea or coffee.

⑤ If clothing has been contaminated, remove the clothing and wash the subject's skin thoroughly with soap and water; then flush the skin with plenty of water.

⑥ If the chemical has been inhaled, get the victim into fresh air immediately. If breathing has stopped, apply artificial respiration (see p. 32). Get medical attention.

⑦ If the chemical has gotten into the victim's eyes, flush the eyes with plenty of water for at least 5 minutes. Get medical attention immediately.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Brozone	Internal----	①	CDEC	Internal----	①
	External---	⑤		External---	⑤
	Inhalation--	⑥		Eye-----	⑦
Cacodylic acid	Internal----	①	Chlorates, including magnesium and sodium salts	Internal----	①
Cadmium	Internal----	①			
	Inhalation--	⑥	Chlorbenside	External---	⑤
Calcium arsenate	Internal----	①		Eye-----	⑦
Captan	Internal----	①	Chlordane	Internal----	①
Carbaryl	Internal----	①		External---	⑤
	External---	⑤	Chlorobenzilate	Internal----	①
Carbon disulfide	Internal----	②	Chloroform	Inhalation--	⑥
	External---	⑤	Chloropicrin	External---	⑤
	Inhalation--	⑥		Inhalation--	⑥
	Eye-----	⑦		Eye-----	⑦
Carbon tetrachloride	Internal----	①	Ciodrin	Internal----	①
	External---	⑤		External---	⑤
	Inhalation--	⑥		Eye-----	⑦
Carbophenothion	Internal----	①	CIPC	Internal----	①
	External---	⑤		External---	⑤
	Eye-----	⑦	Citronella, oil of	Internal----	①
CDAA	Internal----	①	Copper compounds	Internal----	①
	External---	⑤		External---	⑤
	Eye-----	⑦	CP 15336	Internal----	①
			Cryolite	Internal----	①

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Cyanamid	Internal....	①	Dalapon and salts	External...	⑤
	External...	⑤		Eye.....	⑦
Cyanide, calcium	Internal....	①	DATC	Internal....	①
Cyanide, inorganic	Internal....	①		External...	⑤
	Inhalation..	⑥		Eye.....	⑦
Cynem	Internal....	①	DCPA	External...	⑤
	External...	⑤		Inhalation..	⑥
	Eye.....	⑦		Eye.....	⑦
	Inhalation..	⑥	DCU	Internal....	①
2, 4-D	Internal....	①		Eye.....	⑦
	External	⑤	DDD	Internal....	①
	Eye	⑦		Internal....	①
DAC	Internal....	①	DD-Mixture	Internal....	①
				External...	⑤

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

TREATMENT

Apply the treatment whose number corresponds to the number in the third column of the table, opposite the type of poisoning to which the victim has been exposed.

① Induce vomiting by giving victim a tablespoon of salt in a glass of warm water. Repeat treatment until vomit fluid is clear. Have victim lie down and keep warm and quiet until a physician arrives.

② *Do not* induce vomiting. Give victim large quantities of milk, or whites of eggs beaten in water.

③ Give victim a cathartic—2 tablespoons of Epsom salt in water, or milk of magnesia in either milk or water.

④ Give victim a stimulant—plenty of strong tea or coffee.

⑤ If clothing has been contaminated, remove the clothing and wash the subject's skin thoroughly with soap and water; then flush the skin with plenty of water.

⑥ If the chemical has been inhaled, get the victim into fresh air immediately. If breathing has stopped, apply artificial respiration (see p. 32). Get medical attention.

⑦ If the chemical has gotten into the victim's eyes, flush the eyes with plenty of water for at least 5 minutes. Get medical attention immediately.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
DDT	Internal....	①	Dichlorovos	Internal....	①
	External...	⑤		External...	⑤
DDVP	Internal....	①		Inhalation..	⑥
	External...	⑤		Eye.....	⑦
	Eye.....	⑦	Dicryl	Internal....	①
Def	Internal....	①	Dieldrin	Internal....	①
	External...	⑤		External...	⑤
Demeton	Internal....	①		Eye.....	⑦
	External...	⑤	Dilan	Internal....	①
Diallate	Internal....	①		External...	⑤
	External...	⑤		Eye.....	⑦
	Eye.....	⑦	Dinitrocresol	Internal....	①
Diazinon	Internal....	①		External...	⑤
	External...	⑤		Eye.....	⑦
	Eye.....	⑦	Di-n-propyl maleate isosafrol condensate (n-propyl isomer)	Internal....	①
Dibrom	Internal....	①			
	External...	⑤	Dioxathion	Internal....	①
Dibutyl succinate	Internal....	①		External...	⑤
			Diphacinone	Internal....	①
Dicamba	Internal....	①			
Dichlobenil	Internal....	①	Diphenamid	Internal....	①
Dichlone	External...	⑤	Diphenatrile	Internal....	①
	Eye.....	⑦			
Dichloroethyl ether	External...	⑤	Diphenylamine	Internal....	①
	Inhalation..	⑥			
			Diquat	Internal....	①
				External...	⑤
			DiSyston	Internal....	①

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Diuron	Internal....	①	Endosulfan	Internal....	①
	External...	⑤		External...	⑤
	Eye.....	⑦		Eye.....	⑦
DMPA	External...	⑤	Endothall	Internal....	②
	Eye.....	⑦		External...	⑤
DNBP	External...	⑤		Eye.....	⑦
	Eye.....	⑦	Endrin	Internal....	①
DNSBP	External...	⑤		External...	⑤
	Eye.....	⑦		Eye.....	⑦
Dowfume MC-2	Internal....	①	EPN	Internal....	①
	External...	⑤		External...	⑤
	Inhalation..	⑥		Inhalation..	⑥
	Eye.....	⑦		Eye.....	⑦
			EPTC	Internal....	①

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

TREATMENT

Apply the treatment whose number corresponds to the number in the third column of the table, opposite the type of poisoning to which the victim has been exposed.

① Induce vomiting by giving victim a tablespoon of salt in a glass of warm water. Repeat treatment until vomit fluid is clear. Have victim lie down and keep warm and quiet until a physician arrives.

② *Do not* induce vomiting. Give victim large quantities of milk, or whites of eggs beaten in water.

③ Give victim a cathartic—2 tablespoons of Epsom salt in water, or milk of magnesia in either milk or water.

④ Give victim a stimulant—plenty of strong tea or coffee.

⑤ If clothing has been contaminated, remove the clothing and wash the subject's skin thoroughly with soap and water; then flush the skin with plenty of water.

⑥ If the chemical has been inhaled, get the victim into fresh air immediately. If breathing has stopped, apply artificial respiration (see p. 32). Get medical attention.

⑦ If the chemical has gotten into the victim's eyes, flush the eyes with plenty of water for at least 5 minutes. Get medical attention immediately.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Erbon	Internal....	①	Fenuron	External...	⑤
	External...	⑤		Eye.....	⑦
	Eye.....	⑦	Ferbam	External...	⑤
Ethion	Internal....	①		Eye.....	⑦
	External...	⑤	Fluoride: inorganic, water soluble	Internal....	①
	Inhalation..	⑥			
	Eye.....	⑦	Folpet	External...	⑤
Ethyl bromide	Inhalation..	⑥	Formaldehyde	Internal....	①
				External...	⑤
Ethylene dibromide	Internal....	①		Inhalation..	⑥
	External...	⑤		Eye.....	⑦
	Inhalation..	⑥	Genite 923	Internal....	①
	Eye.....	⑦			
Ethylene dichloride	Internal....	①	Guthion	Internal....	①
	External...	⑤		External...	⑤
	Inhalation..	⑥		Inhalation..	⑥
	Eye.....	⑦		Eye.....	⑦
EXD	Internal....	①	Heptachlor	Internal....	①
	External...	⑤		External...	⑤
	Eye.....	⑦		Eye.....	⑦
Fenac	Internal....	①	Hypochlorites	Internal....	②
Fenson	Internal....	①		External...	⑤
	External...	⑤		Eye.....	⑦
Fenthion	Internal....	①	I.P.C.	Internal....	①
	External...	⑤	Kelthane	Internal....	①
	Inhalation..	⑥		External...	⑤
	Eye.....	⑦		Eye.....	⑦

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Kepone	Internal ¹ ----	①	Lindane	Internal----	①
	External---	⑤		External---	⑤
	Eye-----	⑦		Eye-----	⑦
Kerosene (alone)	Internal ²	②	Linuron	Internal----	①
KOCN	Internal----	①		External---	⑤
				Inhalation..	⑥
Lead arsenate	Internal----	①		Eye-----	⑦
Lenthane 384	Internal----	①	Malathion	Internal----	①
	External---	⑤		External---	⑤
	Eye-----	⑦	Maleic hydrazide	Internal----	①
Lime sulfur	External---	⑤			
	Eye-----	⑦	Eye-----	⑦	

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

² If a kerosene-base product contains toxic pesticide, follow first-aid directions on the container label.

TREATMENT

Apply the treatment whose number corresponds to the number in the third column of the table, opposite the type of poisoning to which the victim has been exposed.

① Induce vomiting by giving victim a tablespoon of salt in a glass of warm water. Repeat treatment until vomit fluid is clear. Have victim lie down and keep warm and quiet until a physician arrives.

② Do not induce vomiting. Give victim large quantities of milk, or whites of eggs beaten in water.

③ Give victim a cathartic—2 tablespoons of Epsom salt in water, or milk of magnesia in either milk or water.

④ Give victim a stimulant—plenty of strong tea or coffee.

⑤ If clothing has been contaminated, remove the clothing and wash the subject's skin thoroughly with soap and water; then flush the skin with plenty of water.

⑥ If the chemical has been inhaled, get the victim into fresh air immediately. If breathing has stopped, apply artificial respiration (see p. 32). Get medical attention.

⑦ If the chemical has gotten into the victim's eyes, flush the eyes with plenty of water for at least 5 minutes. Get medical attention immediately.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
MCPA	Internal....	①	MH	Internal....	①
MCPB	Internal....	①	Mirex	Internal....	①
	Eye.....	⑦		Internal....	①
Mecoprop	Internal....	①	Molinate	Internal....	①
				Eye.....	⑦
Mercury compounds: inorganic salts, except calomel	Internal....	②	Monolinuron	Internal....	①
				External....	⑤
Methaldehyde	Internal....	①	Monuron	Eye.....	⑦
	External....	⑤		Internal....	①
	Eye.....	⑦	Morestan	External....	⑤
Methoxychlor	Internal....	①		Internal....	①
			Mylone	External....	⑤
Methyl bromide	External....	⑤		Eye.....	⑦
	Inhalation..	⑥	Nabam	Internal....	①
	Eye.....	⑦		External....	⑤
Methyl chloride	External....	⑤		Eye.....	⑦
	Inhalation..	⑥	N-1-naphthyl phthalamic acid	Internal....	①
	Eye.....	⑦		External....	⑤
Methylene chloride	Internal....	①	Neburon	External....	⑤
	External....	⑤		Eye.....	⑦
	Inhalation..	⑥	Nemacide (V-C 13)	Internal....	①
Methyl parathion	Internal....	①		External....	⑤
	External....	⑤		Eye.....	⑦
	Inhalation..	⑥	Nemagon	Internal....	①
	Eye.....	⑦		External....	⑤
Methyl Trithion	Internal....	①		Eye.....	⑦
	External....	⑤			
	Inhalation..	⑥			
	Eye.....	⑦			

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Nicotine and its salts	Internal....	① and ④	Orthodichlorobenzene	External...	⑤
	External...	⑤		Eye.....	⑦
	Inhalation..	⑥	Ovex	External...	⑤
	Eye.....	⑦		External...	⑤
Nemex	Internal....	①	Paradichlorobenzene	External...	⑤
	External...	⑤		Eye.....	⑦
	Inhalation..	⑥	Paraquat	Internal....	①
	Eye.....	⑦		External...	⑤
N, N-diethyl toluamide	Internal....	①	Parathion	Internal....	①
	Eye.....	⑦		External...	⑤
N-octal bicycloheptene discarboximide	Internal...	①		Inhalation..	⑥
	Internal....	①		Eye.....	⑦
N-otylsulfoxide of isosafrole	Internal....	①	Paris green	Internal....	①
	Internal....	①		External...	⑤
Norea	Internal....	①			

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides, pp. 59 to 65.

TREATMENT

Apply the treatment whose number corresponds to the number in the third column of the table, opposite the type of poisoning to which the victim has been exposed.

① Induce vomiting by giving victim a tablespoon of salt in a glass of warm water. Repeat treatment until vomit fluid is clear. Have victim lie down and keep warm and quiet until a physician arrives.

② Do not induce vomiting. Give victim large quantities of milk, or whites of eggs beaten in water.

③ Give victim a cathartic—2 tablespoons of Epsom salt in water, or milk of magnesia in either milk or water.

④ Give victim a stimulant—plenty of strong tea or coffee.

⑤ If clothing has been contaminated, remove the clothing and wash the subject's skin thoroughly with soap and water; then flush the skin with plenty of water.

⑥ If the chemical has been inhaled, get the victim into fresh air immediately. If breathing has stopped, apply artificial respiration (see p. 32). Get medical attention.

⑦ If the chemical has gotten into the victim's eyes, flush the eyes with plenty of water for at least 5 minutes. Get medical attention immediately.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
PBA	Internal....	①	Phosdrin	Internal....	①
P-chlorophenyl phenyl sulfone	External...	⑤		External...	⑤
				Inhalation..	⑥
PCP	Internal....	①	Phosphamidon	Internal....	①
	External...	⑤		External...	⑤
	Eye.....	⑦		Inhalation..	⑥
				Eye.....	⑦
PEBC	Internal....	①	Phosphorus, white or yellow	Internal....	①
Pebulate	Internal....	①		External...	⑤
Pentachlorophenol	Internal....	①		Eye.....	⑦
	External...	⑤	Picloram	Internal....	①
	Eye.....	⑦	Pine oil	Internal....	①
Peroxyacetic acid	External...	⑤	Piperonyl butoxide	Internal....	①
Perthane	Internal....	①	Pival	Internal....	①
	External...	⑤	P.M.P.	Internal....	①
	Eye.....	⑦	Potassium cyanate	Internal....	①
Phenols	Internal....	①		External...	⑤
	External...	⑤		Inhalation..	⑥
	Eye.....	⑦	Pyrazon	Internal....	①
Phenyl mercuric acetate	Internal....	① and ④		External...	⑤
	External...	⑤	Pyrethrins	Internal....	①
	Eye.....	⑦		External...	⑤
Phorate	Internal....	①		Eye.....	⑦
	External...	⑤	Quaternary ammonium compounds	Internal....	①
	Inhalation..	⑥		External...	⑤
	Eye.....	⑦		Eye.....	⑦
			Red squill	Internal....	①

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Ronnel	Internal....	①	Shell Compound 4072	Internal....	①
	External...	⑤		External...	⑤
	Inhalation..	⑥		Inhalation..	⑥
	Eye.....	⑦		Eye.....	⑦
Rotenone	External...	⑤	Siduron	Internal....	①
	Eye.....	⑦	Silvex	Internal....	②
Ryania	Internal....	①		Eye.....	⑦
Sabadilla powder	External...	⑤	Simazine	Internal....	①
	Eye.....	⑦	Sodium isopropyl • xanthate	External...	⑤
Sesamin	Internal....	①		Eye.....	⑦
Sesone	Internal....	①	Sodium trichloroacetate	External...	⑤
	External...	⑤		Eye.....	⑦
	Eye.....	⑦			

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

TREATMENT

Apply the treatment whose number corresponds to the number in the third column of the table, opposite the type of poisoning to which the victim has been exposed.

① Induce vomiting by giving victim a tablespoon of salt in a glass of warm water. Repeat treatment until vomit fluid is clear. Have victim lie down and keep warm and quiet until a physician arrives.

② Do not induce vomiting. Give victim large quantities of milk, or whites of eggs beaten in water.

③ Give victim a cathartic—2 tablespoons of Epsom salt in water, or milk of magnesia in either milk or water.

④ Give victim a stimulant—plenty of strong tea or coffee.

⑤ If clothing has been contaminated, remove the clothing and wash the subject's skin thoroughly with soap and water; then flush the skin with plenty of water.

⑥ If the chemical has been inhaled, get the victim into fresh air immediately. If breathing has stopped, apply artificial respiration (see p. 32). Get medical attention.

⑦ If the chemical has gotten into the victim's eyes, flush the eyes with plenty of water for at least 5 minutes. Get medical attention immediately.

Table 1.—First-aid treatments for chemical poisoning—Continued

Commonly used name of chemical ¹	Type of poisoning	Treatment	Commonly used name of chemical ¹	Type of poisoning	Treatment
Sorbic acid	Internal....	①	Thanite	Internal....	①
Strobane	Internal....	①		External...	⑤
	External...	⑤		Eye.....	⑦
	Eye.....	⑦	Thiram	Internal....	①
Strychnine, and its salts (sulfate)	Internal....	①	Toxaphene	Internal....	⑦
Sulfur	Eye.....	⑦		External...	①
Sulphenone	Internal....	⑦		Eye.....	⑤
2, 4, 5-T	Internal....	①	Trialate	Internal....	⑤
	External...	②		External...	⑦
	Eye.....	⑤	Trichlorfon	Internal....	⑦
Tartar emetic	Internal....	⑦	Vernolate	Internal....	①
	External...	①	Warfarin	Internal....	①
	Eye.....	①	Zectran	Internal....	①
TCA	Internal....	②		External...	⑤
	External...	⑤		Eye.....	⑦
	Eye.....	⑦	Zinc phosphide	Internal....	①
TDE	Internal....	①		External...	⑤
1080 (Ten eighty)	Internal....	①		External...	①
	External...	⑤		Eye.....	⑤
	Eye.....	⑦	Zinc salts (considered as zinc, not as anions)	Internal....	① and ③
Tepp	Internal....	①	Zineb	Inhalation..	⑥
	External...	⑤		Eye.....	⑦
	Inhalation..	⑥		External...	①
	Eye.....	⑦		External...	⑤
Tetraethyl dithio- nopyrophosphate	Internal....	①	Zinophos	Inhalation..	⑥
	External...	⑤		Eye.....	⑦
	Inhalation..	⑥	Ziram	External...	⑤
Thallium sulfate	Internal....	⑦		External...	⑤
	External...	⑤		Eye.....	⑦
	Eye.....	⑦		Eye.....	⑦

¹ If you know only the chemical name, find the commonly used name by referring to "Chemical and Commonly Used Names of Agricultural and Household Pesticides," pp. 59 to 65.

Artificial Respiration

There are various effective ways to give artificial respiration manually. The *back-pressure-arm-lift* method is described here.

If there is foreign matter visible in the victim's mouth, wipe it out quickly with your fingers or a cloth wrapped around your fingers. Then follow this procedure:

1. *Position of the subject.*—Place the victim face-down, bend his elbows and place his hands one

upon the other, turn his head slightly to one side and extend it as far as possible, making sure that the chin is jutting out. (See fig. 15.)

2. *Position of the operator.*—Kneel at the head of the victim. Place your hands on the flat of his



Figure 15.—Position of the subject.

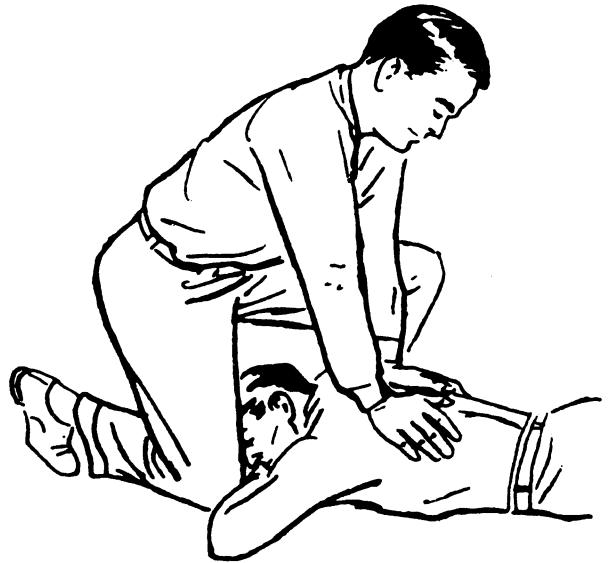


Figure 17.—Compression phase.

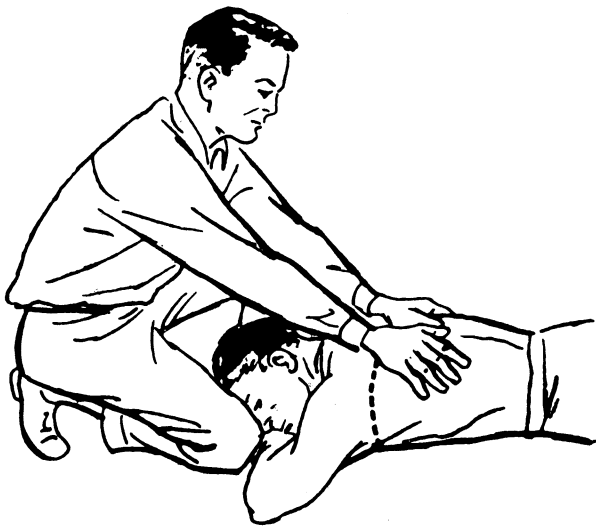


Figure 16.—Position of the operator.



Figure 18.—Expansion phase.

back so the palms lie just below an imaginary line running between the armpits. (See fig. 16.)

3. *Compression phase.*—Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert steady, even pressure downward upon the hands. (See fig. 17.)

4. *Expansion phase.*—Immediately draw the victim's arms upward and toward you, applying enough lift to feel resistance and tension at his shoulders. (See fig. 18.) Then lower the victim's arms to the ground.

Repeat this cycle about 12 times per minute, checking the mouth frequently for obstruction.

If an assistant is available, have him hold the victim's head so the jaw continues to jut out. (See fig. 19.) The assistant should be alert to detect any stomach contents in the mouth, and keep the mouth as clean as possible at all times.

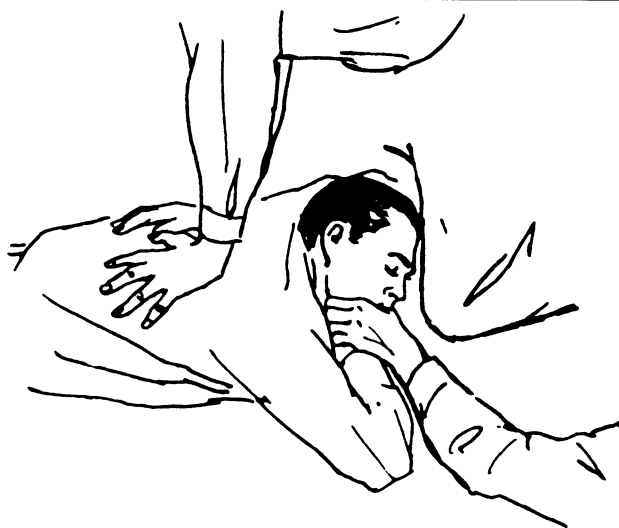


Figure 19.—Assistant can hold victim's head and keep his mouth clean.

PROTECTING WILDLIFE FROM PESTICIDES

It is estimated that only a small percent of the total area of the United States is being treated with pesticides each year. Most of the untreated areas are wooded or wilderness land, or rangeland—natural habitats of wildlife.¹

It might appear, therefore, that injury to wildlife from pesticides must be confined to relatively small geographic areas. However, improperly handled pesticides may be carried by wind or water into adjacent or distant areas; in those areas also they may contaminate fish or other forms of wildlife.

Pesticides are essential to the protection of our forests and rangelands. They are also used to improve game habitat, and to destroy undesirable species that harm or compete with game. Their use may cause some harm to wildlife. But this harm can be minimized if pesticides are handled judiciously and with caution.

Desirable wildlife contributes substantially to our health, happiness, and welfare. Bees pollinate plants that produce our food. Fish serve as food and prevent decaying matter from polluting our rivers, lakes, and streams. Wild creatures help

make nature beautiful and enhance enjoyment of outdoor life. We must protect them from unnecessary injury.

Following are outlined the basic precautions that will minimize pesticide injury to wildlife. The ways in which these precautions can be effectively applied vary widely, and must be determined by pesticide users in the light of conditions that prevail in their individual situations.

Protecting Fish, Birds, and Mammals

Pesticides can cause unnecessary injury to wildlife chiefly by the following occurrences:

1. Drift of pesticides to wooded areas occupied by wildlife; drift to land areas not intended for treatment; and drift to fish-bearing waters.
2. Runoff or washoff by rain from treated areas to fish-bearing waters.
3. Applications made too often or in excessive dosages.
4. Applications of pesticides that have toxicities unnecessarily high for the required control.
5. Applications made at the wrong times.
6. Carelessness.

¹ The term "wildlife" is used here in its broad sense, which includes fish, birds, beneficial insects, and all other forms of animal life that have not become domesticated.

Observe these precautions:

1. Use the least toxic and least persistent pesticide that is effective for your purpose.

2. Guard against drift of pesticides to wooded areas inhabited by wildlife.

- When there is a choice between a coarse spray and a dust, apply a coarse spray.

- Use granular forms of pesticide where they are as effective as sprays or dusts. Granules are seldom a drift hazard.

- Where practicable, apply pesticide with ground equipment rather than aircraft; drift from ground application is more easily controlled.

- Do not apply pesticide when wind velocity is high enough to cause significant movement of pesticide from the target area.

- Follow pesticide label precautions for wildlife protection.

3. Prevent runoff of pesticides into fish-bearing waters.

- Mix pesticides, and fill, empty, or repair application equipment, in an area from which spilled pesticide cannot drain or be washed by rain into ponds, lakes, streams, or other bodies of water.

- Do not use streams or the borders of lakes or ponds as boundaries of plots to be treated. Set the boundaries far enough back from these places so the pesticide cannot run or be washed into them. (This does not apply to the controlled use of herbicides for the treatment of vegetation at the water's edge.)

- Do not treat extensive areas of water in one operation; the decaying vegetation that would result might deplete the oxygen content of the water to the point of causing fish kills.

- If the pesticide label so specifies, consult State water authorities before applying pesticide directly to water.

4. Where practicable, time pesticide applications so they will not be made during the spring migration and nesting period of birds. Consult your county agricultural agent, state fish and game department, or a field office of the fish and wildlife service for further information.

Protecting Honey Bees

The pollination of certain crops by honey bees and other insects is important to our agriculture. It is in our best interest, therefore, to protect these pollinators when we use pesticides.

Many honey bee colonies in the United States are made unproductive each year by careless use of pesticides. Much of this loss can be prevented by

the observance of simple precautions.

Bees may be poisoned when they feed on nectar or pollen contaminated with certain pesticides. They may also be poisoned when they fly through a cloud of pesticide dust or spray, or walk on the treated parts of a plant. They may be overcome by the fuming action of certain pesticides, either in the field or in the hive if the material has drifted there.

Protect bees by observing these precautions:

Grower Precautions

1. *Use pesticide only when necessary.*—Do not apply a pesticide unless its benefit will outweigh any injury it might cause to pollinators.

Consider the effect the pesticide will have on the pollination of crops in the area. An application of insecticide on tasseling corn, for example, might increase the production of the corn, but by reducing the population of insect pollinators it could seriously reduce the production of legumes, cucurbits, melons, or fruits in adjoining fields.

2. *Select the right pesticide.*—All pesticides are not equally dangerous to bees. Some pesticides may kill an entire colony; others may weaken it severely; and still others may cause no appreciable damage. The grower should avoid use of the more hazardous materials on flowering plants attractive to bees. Although honey bee colonies may be removed, there is no practical way to protect native bees from hazardous pesticides. (See the accompanying list, "Relative Hazards of Insecticides to Honey Bees.")

3. *Notify beekeepers.*—Beekeepers should be notified several days before pesticide is applied to an area. This will give them an opportunity to move or otherwise protect the colonies.

4. *Prevent drift.*—Bees sometimes cluster outside the hive entrance on hot evenings. If this occurs where the colonies are likely to be exposed to drifting pesticide, the applications should be delayed until the bees move inside the hive. If a toxic material drifts into the apiary, the bees may be killed by its fuming action or by direct contact with it even when they are in the hive. Therefore, care should be taken to prevent the drift of pesticides near bee colonies.

5. *Use sprays instead of dusts.*—Most sprays are coarser than dusts and do not drift as far or remain in the air as long as dusts. When a pesticide is applied in spray form, bees are usually less seriously injured than when the same material is applied in dust form.

Granular formulations are less likely to drift than than either dusts or sprays; they are seldom hazardous to bees.

6. *Use ground equipment.*—Aircraft discharge a greater volume of pesticide, at higher altitudes, and with greater turbulence than ground machines. This greater volume increases the likelihood that flying bees will come in contact with the material. The greater turbulence and altitude increase the likelihood of drift onto adjacent crops where bees may be foraging. Thus, pesticides applied by ground equipment will usually cause less injury to

bees than the same materials applied by aircraft.

7. *Time pesticide applications.*—Least damage will occur to the bees if the crop is treated at a time when it is unattractive to them. This may be before or after flowering; it may be at night; or it may be at a time of day when bees are not visiting the plants. For example, a highly toxic material may be applied to alfalfa before the flowers appear, and may cause no damage to nearby bee colonies; the same material applied a week or two later to the same field when it is in bloom may kill or seriously damage the colonies.

RELATIVE HAZARDS OF INSECTICIDES TO HONEY BEES

[A list of commonly used Insecticides, grouped according to their relative hazards to honey bees. Terms preceded by an asterisk (*) are trade names.]

Group 1.—*Hazardous to Bees if They Are Present at Time of Treatment or Within a Few Days Afterward*

Aldrin	Dichlorvos	Methyl
Arsenicals	Dieldrin	parathion
Benzene	Dimethoate	*Methyl
hexachloride	EPN	Trithion
*Bidrin	Fenthion	Mevinphos
Calcium	*Guthion	Naled
arsenate	Heptachlor	Parathion
Carbaryl	Lead arsenate	Phosphamidon
Chlordane	Lindane	TEPP
*Ciodrin	Malathion	*Zectran
Diazinon		*Zinophos

Group 2.—*Hazardous to Bees Only if Applied Where They Are Foraging*

Carbophenothion	*Di-Syston	*Perthane
Chlorobenzilate	Endosulfan	Phorate
Coumaphos	Endrin	Ronnel
DDT	Fenson	TDE
	Mirex	

Group 3.—*Relatively Nonhazardous to Bees*

Allethrin	Dioxathion	Rotenone
*Aramite	Ethion	Ryania
Binapacryl	*Genite 923	*Strobane
Bordeaux	*Kelthane	Sulfur
mixture	Methoxychlor	Tetradifon
Chlorbenzide	*Morestan	Toxaphene
Cryolite	Nicotine sulfate	Trichlorfon
Dalapon	Ovex	Zineb
Demeton	Pyrethrins	Ziram
*Dilan		

Beekeeper Precautions

1. *Place colonies in a safe area.*—Bee colonies should be placed beyond the borders of a field likely to be treated with a pesticide toxic to them.

2. *Know the pesticides.*—Beekeepers should have a knowledge of the pesticides commonly used in their areas, and should understand their effects on bees. They should be prepared to protect the bees if informed that a highly toxic material is to be applied.

3. *Identify the colonies.*—The name, address, and telephone number of the beekeeper should be placed conspicuously in the apiaries. Neighboring farmers should be informed of the apiaries' new location, and requested to notify the beekeeper if they plan to apply highly toxic pesticide.

4. *Confine the colonies.*—When very toxic pesticides are to be applied, the bee colonies may be covered with plastic sheeting that will confine the colonies and exclude pesticide spray, dust, or fumes. Heat builds up rapidly under plastic exposed to the sun. Therefore the confinement should be limited to a few hours after dawn. This may be long enough to protect the bees from some pesticides, applied at dawn, that do not have a long residual effect.

Colonies may be covered with wet burlap for a day or more, even during the hottest weather, and the bees will not suffer from lack of air or water. They should be covered at night when all the bees are in the hives. During the day, sprinkle the burlap with water hourly or more often (fig. 20). Burlap probably would not give complete protection to colonies located in a field treated with a pesticide that has fuming action.

Bees use water in their food and for cooling the hive. Colonies under confinement soon become stressed if they lack water. Water shortage causes symptoms similar to spray poisoning. If wet bur-



Figure 20.—Using wet burlap to protect colonies from pesticide: A, Covering the colonies; B, sprinkling the burlap.

lap is used to cover colonies, it provides water for the bees and helps cool the colony.

5. *Move the colonies.*—When some of the highly toxic pesticides are to be applied repeatedly to the same area, the only way to protect bee colonies is to move them several miles from the treated area. Moving has disadvantages. It usually is an emergency measure, requires hard work, and must be done at night when the bees are in the hive. Also, the apiaries often must be moved to a less satisfactory location. A possible solution to this problem is to convince the neighboring *grower* that the bees are important to *him* as pollinators of crops. If he will use the pesticides that are the least toxic to bees, it may eliminate the necessity of moving the bees from place to place.

Protecting Wildlife in Forest Pest-Control Operations

Some of the most important pest-control operations in the United States are for the protection of our forests, national parks, and rangelands.

In an average year, insects and disease organisms kill about 2.38 billion cubic feet of timber in this country. The destruction would be many times as great were it not that the U.S. Departments of Agriculture and the Interior, as well as State agencies, wage a continuing fight against forest and rangeland pests. Their chief weapons are chemical pesticides applied by ground methods or by aircraft.

In their use of pesticides, Government agencies follow the basic practices described in this publication for the protection of wildlife. Each pest-control program is carefully planned. Before pesticide is applied, any clearance required by State or local regulation is obtained. The least hazardous of effective chemicals are used, at the lowest effective dosage. To protect aquatic life, strips along lake shores and large streams are left untreated; only part of an area containing major fish-bearing streams is treated in any one year. Pilots are instructed not to treat sensitive areas, and to apply pesticides so they will not drift outside target areas.

FEDERAL LAW GOVERNING PESTICIDE LABELING AND MARKETING

The labeling and marketing of pesticides sold or distributed in interstate commerce are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act of 1947, as amended.¹ In the language of the Act, the materials are referred to as economic poisons, but they are commonly called pesticides.

The Act defines an economic poison as (1) "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insects, rodents, nematodes, fungi, weeds, or other forms of plant or animal life or viruses, except viruses on or in living man or other animals, which the Secretary of Agriculture shall declare to be a pest," and (2) "any substances or mixture of substances intended for use as a plant regulator, defoliant, or desiccant."

The basic purpose of the Act is protection of the public from personal or economic injury. This law guards not only purchasers of pesticides, but all persons who may come in contact with them or with materials that may have been treated with them. A further purpose is to reduce possible pesticidal hazard to wildlife, crops, and soil.

Responsibility for administering the Federal Insecticide, Fungicide, and Rodenticide Act is assigned to the U.S. Department of Agriculture, and has been delegated by the Secretary of Agriculture to the Department's Pesticides Regulation Division.

Obtaining Registration

Before a pesticide can be legally marketed in interstate commerce it must be registered with the Pesticides Regulation Division. To obtain registration, a manufacturer must submit copies of his label and adequate research data to support all the claims made for his product. The label and supporting data are carefully reviewed by specialists to determine the following:

1. Will the product be effective against the pests named on the label and can it be used effectively

¹ Copies of the Act and regulations for its enforcement are available from Pesticides Regulation Division, U.S. Department of Agriculture, Washington, D.C. 20250.

without causing damage to the crops or objects to which it is applied?

2. Does the label bear warning and caution statements that are adequate, when complied with, to prevent injury to the user or other persons or beneficial animals that are exposed?

3. Will the product, when used as directed, leave residues in excess of legal tolerance² on or in harvested food or feed?

The pesticide manufacturer must petition the Food and Drug Administration to set a tolerance for his product to cover any residues likely to result when the product is used for the purpose that will be stated on its label.

When the tolerance is established, scientists in the Department of Agriculture's Pesticides Regulation Division will approve registration of the product only after ascertaining that its residues will be within the prescribed limits when used according to directions on the label.

² A tolerance is the maximum amount of pesticide residue that may lawfully remain on food or feed when it is marketed or used; it is expressed in parts per million, by weight. Residue tolerances are established by the Food and Drug Administration, U.S. Department of Health, Education, and Welfare, under provisions of the Federal Food, Drug, and Cosmetic Act. This Act is enforced by the Food and Drug Administration.

SCOPE OF THE FEDERAL ACT

The Federal Act applies to pesticides sold or distributed in interstate commerce, to those sold or distributed within the District of Columbia or the Territories, and to those exported or imported in foreign commerce, with these exceptions:

The Act does not apply to pesticides shipped in interstate commerce and used for experimental purposes by agencies authorized by law to conduct research in this field. However, shipments for experimental use by others are subject to temporary-permit requirements.

Economic poisons delivered for shipment to a foreign country are not subject to the Act when they are prepared or packed in accordance with specifications or directions of the foreign purchaser.

If the examining scientists find that the product or its labeling does not meet the requirements of the law, the applicant is notified. He is given an opportunity to make appropriate changes and, when necessary, submit additional supporting data.

If the scientists are convinced that the product can be used effectively and safely without leaving illegal residues in or on food or feed when label warnings and directions are carefully followed, a registration is issued. A copy of the application is stamped "Accepted," is dated, and is returned to the applicant.

Federal registration is valid for 5 years, after which it is canceled unless the registrant requests that it be extended. A registration may be denied or canceled at any time such action is found necessary to protect the public.

Most States have laws similar to the Federal Insecticide, Fungicide, and Rodenticide Act, regulating the marketing of pesticides within the State. *Federal registration does not remove the requirement for State registration.*

Labeling Regulations

The Federal Insecticide, Fungicide, and Rodenticide Act provides that certain information be printed on the container labels of registered pesticides. This provision is made for the protection of humans, domestic animals, wildlife, crops, water supplies, and other values. It also helps to prevent fraudulent merchandising.

All users of pesticides—from housewives to commercial pest-control operators—should become familiar with the labeling facts that follow, and should use them as a guide in the purchase and safe application of these materials. Almost anyone may need to become a user at one time or another.

The label of a registered pesticide usually must carry the following information:

- Brand name or product name.
- Ingredient statement.
- Warning or caution statement.
- Directions for use.¹
- Net contents.
- Name and address of manufacturer.
- The USDA registration number.

¹ Directions for use of agricultural pesticides may be carried on leaflets or other printed matter that accompanies the products.

Brand Name or Product Name

The name used on the container label must not be misleading in any respect, including the composition, usefulness, or safety of the product. Even if a name is registered by the Patent Office as a trademark, it may not be used on the label if it is misleading.

Ingredient Statement

The label on a pesticide container must bear either—

1. A statement of the name and *percentage of each* active ingredient and the *total percentage* of the inert ingredients, or
2. A statement of the names of the active ingredients in the descending order of the quantities present, followed by a statement of the names of each of the inert ingredients, if any, in the descending order of the *amount of each*, and the *total percentage* of the inert ingredients.

Warning or Caution Statement

For determining the needed precautionary labeling, pesticides have been classified in four categories of toxicity. The category in which a pesticide is classed determines the type of warning or



Figure 21.—Scientist analyzes sample of a pesticide to determine whether it leaves a residue.

caution statement that must appear on the label, as follows:

- Products in category I are classed as *highly toxic*, and this must be indicated clearly and prominently on the label. The labels of pesticides in this category must bear (1) a skull and crossbones and the word POISON printed in red; (2) the "signal" word DANGER, the sentence KEEP OUT OF REACH OF CHILDREN, and an appropriate warning statement; (3) an antidote statement; (4) emergency first-aid instructions that can be followed by a layman; and (5) the instruction "If swallowed, or if symptoms of poisoning occur, call a physician immediately."

- Products in category II are classed as in the range of one-tenth as toxic as those in category I. Their label requirements are the same as for products in category I except that the skull and crossbones and the word POISON is not required and the signal word is WARNING. The label must bear the sentence KEEP OUT OF REACH OF CHILDREN, and an appropriate warning statement.

- Products in category III are classed as in the range of one-tenth as toxic as those in category II. These are *slightly toxic*. Their labels must bear the signal word CAUTION, the sentence KEEP OUT OF REACH OF CHILDREN, and an appropriate caution statement.

- Products in category IV are classed as in the range of one-tenth as toxic as those in category III. These have little or no toxicity and may not require a caution or antidote statement. Some may be irritating to the skin, nose and throat, or eyes; if so, their labels should carry this information.

For certain pesticides, special caution statements may be required on the label. These are examples:

- **FLAMMABLE!** Keep away from open flame. Turn off pilot lights and electric motors before using.

- Contents under pressure. Do not store near heat or open flame.

- Avoid spray drift to susceptible plants. This product may injure cotton, beans, peas, or ornamentals. It is less likely to drift when applied as a coarse spray.

- Thoroughly clean spray equipment with a suitable chemical cleaner before using it to apply other material.

- Do not store near fertilizer, seeds, insecticides, or fungicides.

- Vapors from this product may injure susceptible plants in the immediate vicinity.

Directions for Use

The Federal Insecticide, Fungicide, and Rodenticide Act specifies that pesticide labeling must bear directions for the product's use, and that the directions, when complied with, must be adequate for the protection of users and the public.

Label statements of intended use must be specific and not false or misleading. Unjustifiable broad claims, promising or implying performance that the product cannot deliver, must not appear on the label.

The need for detailed directions for use is considered greater on products intended for household or home-garden use than on products intended for large-scale agricultural use. Detailed directions for use may not be required on products intended for use by commercial pest-control operators or for products intended for use in manufacturing processes.

Directions for use must be stated in such terms and with such clearness that they will be readily understood by the user. Under some circumstances, directions for use may be printed in a leaflet or circular accompanying the product rather than on the container label.

Net Contents

The container label of a registered pesticide must bear a statement of the net weight or measure of the content. If the product is a liquid, the content must be stated in terms of liquid measure; if it is solid, semisolid, viscous, or a mixture of solid and liquid, the content must be stated in terms of weight.

Name and Address of Manufacturer

The name and address of the manufacturer, registrant, or person or firm for whom the product is registered must appear on the label of a registered pesticide. If the name is other than that of the manufacturer, the label should indicate this fact.

USDA Registration Number

All labels must bear the registration number assigned to the product. The number must be preceded by the phrase "USDA Registration No." or "USDA Reg. No."

Enforcement Procedures

After a product is on the market it must continue to meet the requirements of the Federal Insecticide, Fungicide, and Rodenticide Act. The Pesticides Regulation Division is responsible for enforcing the Act.

The Division has inspectors located throughout the United States who check pesticides offered for sale at wholesale and retail levels.

The inspectors purchase samples of pesticides on the open market, and send them to the Division's laboratories for examination. Many States cooperate with the Division in the collection of pesticide samples. The samples are analyzed to determine whether the ingredients are present in the amounts stated on the label, and whether the products contain any adulterants.

Laboratory or field tests may also be made to determine the effectiveness of the product when used according to label directions. Pharmacological tests are made to determine whether safety precautions on the label are adequate.

If a product is found to be in violation of the law, legal action is taken against the shipper. For minor violations, this may consist of instructing the shipper to bring it into compliance with the law. If the violation is more serious, the shipment may be seized and, if necessary, criminal action may be brought against the shipper.



Figure 22.—Sample of a pesticide purchased from a retail store is sealed before it is sent to the Pesticides Regulation Division's laboratories for chemical and biological evaluations.

RELATIVE TOXICITY OF CHEMICAL PESTICIDES

The hazards associated with the use of chemical pesticides are often in ratio to the relative toxicities of the materials. The toxicities depend largely on the nature of the active ingredients and the percent of their concentration in the mixtures or dilutions that are handled or applied.

But the hazard of a chemical may depend more on the way it is used than on its inherent toxicity. For example, a highly toxic material applied in a low concentration or at a low dosage may be less hazardous than a much less toxic material applied in a high concentration or at a high dosage.

The following table was prepared by the Pesticides Regulation Division, Agricultural Research Service. It shows the relative toxicities to humans of the commonly used agricultural and household pesticides. The data in the table are based on extensive tests, and are used as a guide in the regula-

tion of pesticide registration and labeling.

Terms used in the table to indicate relative toxicities are equivalent to terms required on labels of registered pesticides, as follows:

- *Very high* applies to products in Registration Category I, whose labels are required to bear a skull and crossbones and the words, "Danger—Poison."

- *High* applies to products in Category II, whose labels are required to bear the word, "Warning," and a warning statement.

- *Medium* applies to products in Category III, whose labels are required to bear the word, "Caution," and a caution statement.

- *Low* applies to products in Categories III or IV whose labels may or may not be required to carry a caution statement.

(See "Warning, or Caution Statement," p. 38.)

Table 2.—Relative toxicities of agricultural and household pesticides

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Acetone	Acetone	Liquid	50 and above	Low
Acrolein	2-Propenal	Liquid	Technical	Very high
Acrylonitrile	Acrylonitrile	Liquid	39.5	Very high
Aldrin	Hexachloro hexahydroendo, exodimethanonaphthalene (95%)	Wettable powder	60 and above	Very high
		Granules	10 to 60	High
		Dust or granules	Below 10	Medium
		Spray, solution, dust, or fertilizer	Usual ²	Low
Allethrin	Allyl homolog of cinerin I	Dust	Below 1.0	Medium
Allyl alcohol	2-Propene-1-ol	Technical or aerosol	81.0	High
Alpha naphthylthiourea	Alpha naphthyl thiourea	Bait	30 and above	Very high
			Below 30	High
Amiben	3-Amino-2,5-dichlorobenzoic acid	Emulsifiable concentrate, or granules	Usual ²	Medium

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Amitrole	3-Amino-1,2,4-triazole	Wettable powder, liquid, or aerosol	Usual ²	Low
Ammonium nitrate	Ammonium nitrate	Liquid	Usual ²	Medium
Ammonium sulfamate	Ammonium sulfamate	Powder	80 and 95	Low
AMS	Ammonium sulfamate	Wettable powder	Usual ²	Low
*Aramite	2-(p-tertiary-butyl-phenoxy) isopropyl-2-chloroethyl sulfite	Wettable powder, or emulsifiable concentrate	Usual ²	Medium
Arsenic compounds, inorganic insoluble	Arsenic compounds, inorganic insoluble (various compounds)	Dust, liquid, or wettable powder	50 and above arsenic	Very high
			10 to 50 as arsenic	Medium
		Solution, dust, or wettable powder	Below 10 as arsenic	Medium
			5 and above as arsenic	Very high
			1 to 5 as arsenic	High
			Below 1 as arsenic	Medium
Arsenite desiccant	Arsenic acid	Liquid	Usual ²	Very high
Arsonate, calcium propyl	Calcium propylarsonate	Dust or wettable powder	Usual ²	High
Arsonates, except calcium propyl arsonate	Arsonates, except calcium propyl arsonate (various compounds)	Dust or wettable powder	Usual ²	Medium
Atrazine	2-Chloro-4-ethylamino-6-isopropylamino-s-triazine	Wettable powder	80	Medium
Barban	4-Chloro-2-butynyl m-chlorocarbanilate	Emulsifiable concentrate, or wettable powder	Usual ²	Low
Benefin	N-butyl-N-ethyl-alpha, alpha, alpha-trifluoro-2, 6-dinitro-p-toluidine	Emulsifiable concentrate	Usual ²	Medium
Bensulide	S-ethyl hexahydro-1H-azepine-1-carbothioate	Emulsifiable concentrate, or granules	Usual ²	Medium

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Benzene	Benzene	Liquid	15 and above	Medium
*Bidrin	Dimethyl phosphate of 3-hydroxy N, N-dimethyl-ciscrotonamide	Technical	75 to 90	Very high
Binapacryl	2-sec-butyl-4, 6-dinitro-phenyl 3-methyl-2-butenolate	Emulsifiable concentrate, wettable powder, or dust	Usual ²	Low
Boric acid	Boric acid	Bait	20 and above	Low
Bromacil	5-Bromo-3sec-butyl-6-methyluracil	Wettable powder, or granules	Usual ²	Low
Brozone	Methyl bromide + chloropicrin in petroleum solvent	Liquid (pressurized)	Usual ²	Very high
Cacodylic acid	Dimethylarsinic acid	Emulsifiable concentrate, wettable powder, or on vermiculite	Usual ²	High
Cadmium	(Cadmium compounds)	Dust	29	Very high
Calcium arsenate	Calcium arsenate	Dust or granules	50 and above, as arsenic	Very high
			10 to 50, as arsenic	High
			Below 10	Medium
Captan	N-Trichloromethylthio-4-cyclohexene-1, 2-dicarboximide	Technical, wettable powder, or dust	Usual ²	Low
Carbaryl	1-Naphthyl N-methylcarbamate	Dust or wettable powder	Usual ²	Medium
Carbon disulfide	Carbon disulfide	Emulsifiable concentrate, or solution	90 and above	Very high
			10 to 90	High
			Below 10	Medium
Carbon tetrachloride	Carbon tetrachloride	Emulsifiable concentrate, or solution	10 and above	High
Carbophenothion	S-[(p-chlorophenylthio)methyl] 0, 0-diethyl phosphorodithioate	Wettable powder, or dust	Usual ²	High

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
CDAА	2-Chloro-N, N-diallyl-acetamide	Emulsifiable concentrate, or granules	Usual ²	High
CDEC	2-Chloroallyl diethyl-dithiocarbamate	Emulsifiable concentrate, or granules	Usual ²	Medium
Chlorates, including magnesium and sodium salts	Chlorates (various compounds)	Wettable powder, or dust	Usual ²	Low
Chlorbenside	p-chlorobenzyl p-chlorophenyl sulfide	Wettable powder, or dust	Usual ²	Low
Chlorbenzilate	Ethyl 4, 4'-dichlorobenzilate	Emulsifiable concentrate, wettable powder, or dust	Usual ²	Low
Chlordane	Octachloro-4, 7-methano tetrahydroindane (60%)	Emulsifiable concentrate (Agriculture, industrial use)	25 to 72	Medium
		Technical spray or wettable powder	Usual ²	Medium
		Dust or wettable powder	25 and below	Low
Chloroform	Chloroform	Liquid	10 and above	Medium
Chloropicrin	Trichlorophenyl sulfone	Wettable powder	Usual ²	Very high
Chloropropene (mixed)	Chloropropene (mixed)	Fumigant	Usual ²	High
Chloroxuron	3-[p-(chlorophen-oxy) phenyl]-1, 1-dimethylurea	Wettable powder	50	Medium
*Ciodrin	Dimethyl phosphate of alpha-methylbenzyl-3-hydroxy-cis-crotonate	Oil solution, emulsifiable concentrate, or aerosol	Usual ²	High
CIPC	Isopropyl N-(3-chlorophenyl) carbamate	Emulsifiable concentrate	50 and above	Medium
Citronella, oil of	Citronella, oil of	Liquid lotion, or candle	Usual ²	Medium
Copper compounds	Copper compounds (Various formulations)	Wettable powder or dust	10 and above as copper	Low
Coumaphos	0, 0-diethyl 0.3-chloro-4-methyl-2-oxo-2H-1-benzopyran-7yl phosphorothioate	Wettable powder or dust	Usual ²	High

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
CP 15336	S-2, 3-dichloroallyl N, N-diisopropyl-thiolcarbamate	Emulsifiable concentrate	Usual ²	Medium
Cryolite	Sodium fluoaluminate	Solution, oil or dust	Usual ²	Low
*Cyanamid	Calcium cyanamide	Granules	42	Medium
Cyanide, calcium	Calcium cyanide	Liquid	Usual ²	Very high
Cyanide, inorganic	(Cyanide compounds, inorganic)	Liquid	5 and above	Very high
		Liquid	Below 5	High
Cynem	0, 0-Diethyl 0, 2-pyrazinyl phosphorothioate	Emulsifiable concentrate, or granules	Usual ²	Very high
2, 4-D	2, 4-Dichlorophenoxyacetic acid and inorganic salts or 2, 4-Dichlorophenoxyacetic acid, organic esters, and amine salts	Emulsifiable concentrate, wettable powder, dust, or granules	Usual ²	Low
DAC	Dimethyl-tetrachloroterephthalate	Wettable powder, or granules	Usual ²	Medium
*Dalapon and salts	2, 2-Dichloropropionic acid, and salts	Liquid or wettable powder	20 and above	Low
DATC	S-2, 3-Dichloroallyl N, N-diisopropyl-thiolcarbamate	Emulsifiable concentrate	Usual ²	Medium
DCPA	Dimethyl-tetrachloroterephthalate	Wettable powder, or granules	Usual ²	Medium
DCU	1, 3-Bis(2,2,2-tri-chloro-1-hydroxyethyl) urea	Wettable powder	Usual ²	Low
DDD	Dichlorodiphenyl-dichloroethane	Technical, emulsifiable concentrate, or wettable powder	Above 25	Medium
		Emulsifiable concentrate (agricultural and industrial use); dust or wettable powder (household use)	25 and below	Low
*DD-Mixture	Dichloropropene dichloropropane & related C ₃ hydrocarbons	Technical	Usual ²	High

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
DDT	Dichlorodiphenyl-trichloroethane	Technical, emulsifiable concentrate, or wettable powder	Above 25	Medium
		Dust, wettable powder, (household use); emulsifiable concentrate	25 and below	Low
DDVP	2, 2-dichlorovinyl dimethyl phosphate	Wettable powder or emulsifiable concentrate	3.0 and above	Very high
		Emulsifiable concentrate, or bait.	0.5 to 3.0	High
		Emulsifiable concentrate, or bait.	Below 0.5	Medium
		Resin strips	20	Low
*Def	Tributylphosphorotrithioate	Emulsifiable concentrate, or dust	Usual ²	High
Demeton	0, 0-diethyl 0-(and S-) 2-(ethylthio)ethyl phosphorothioates	Emulsifiable concentrate	2 and below	Very high
		Emulsifiable concentrate	Below 2	High
Diallate	S-2, 3-dichloroallyl N, N-diisopropyl-thiolcarbamate	Emulsifiable concentrate	Usual ²	Medium
*Diazinon	0, 0-diethyl 0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate	Wettable powder or emulsifiable concentrate	15 and above	High
		Dust or granules	Below 15	Medium
		Emulsifiable concentrate, dust, or bait. Aerosol (household use)	0.5	Medium
Dibrom	1, 2-Dibromo-2, 2-dichloroethyl dimethyl phosphate	Emulsifiable concentrate, dust, or bait	Usual ²	Medium
Dibutyl succinate	Dibutyl succinate	Emulsifiable concentrate, or spray	Usual ²	Low
Dicamba	2-Methoxy-3, 6-dichlorobenzoic acid 3, 6-Dichloro-o-anisic acid	Technical, emulsifiable concentrate, or granules	Usual ²	Medium

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Dichlobenil	2, 6-Dichlorobenzonitrile	Wettable powder, or granules	Usual ²	Medium
Dichlone	2, 3-Dichloro-1, 4-naphthoquinone	Wettable powder, or paste	Usual ²	Low
Dichloroethyl ether	Dichloroethyl ether	Liquid	10 and above	High
		Liquid	Below 10	Medium
Dichlorvos	2, 2-dichlorovinyl dimethyl phosphate	Wettable powder or emulsifiable concentrate	3.0 and above	Very high
		Emulsifiable concentrate or bait	0.5 to 3.0	High
		Emulsifiable concentrate or bait	Below 0.5	Medium
		Resin strips	20	Low
*Dieryl	3', 4'-Dichloro-2-methylacrylanilide	Emulsifiable concentrate	Usual ²	Medium
Dieldrin	Hexachloro epoxy ester of benzene sulfonic acid	Granules	10 to 60	High
		Dust or granules	Below 10	Medium
		Fertilizer, dust, spray or solution (household use)	Usual ²	Low
*Dilan	2-Nitro-1, 1-bis(p-chlorophenyl)butane or 2-Nitro-1, 1-bis(p-chlorophenyl)propane or Mixtures of the above	Emulsifiable concentrate, wettable powder, or dust	Usual ²	Low
Dinitrocresol	4, 6-Dinitro-o-cresol	Emulsifiable concentrate	10 and above	Very high
Di-n-propyl maleate isosafrol condensate (n-propyl isomer)	Di-n-propyl maleate isosafrol condensate (n-propyl isomer)	Solution, dust	Usual ²	Low
Dioxathion	2, 3-p-dioxane S.S.-bis (0,0-diethylphosphorodithioate)	Emulsifiable concentrate	25 and above	Very high
		Dust	Usual ²	Medium

¹ Names preceded by an asterisk (*) are trade names.² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Diphacinone	3-Diphenylacetyl-1, 3-indandione and salts	Technical powder	Above 3.0	Very high
		Bait	0.1 to 3.0	High
Diphenamid	N,N-dimethyl-2,2-diphenylacetamide	Wettable powder or granules	Usual ²	Medium
Diphenatrile	Diphenylacetoneitrile	Fertilizer granules or vermiculite	Usual ²	Low
Diphenylamine	Diphenylamine	Dust	25	Medium
*Diquat	6, 7-Dihydrodi-pyrido (1,2-2:2',1'-C) pyrazidinium salt	Wettable powder, emulsifiable concentrate, or dust	Usual ²	High
*DiSyston	0,0-Diethyl S-[2-(ethylthio)ethyl] phosphorodithioate	Wettable powder, or granules	Usual ²	Medium
Diuron	3-(3,4-Dichlorophenyl)-1,1-dimethylurea	Wettable powder or aqueous suspension	Usual ²	Low
*DMPA	0-(2,4-Dichlorophenyl) 0-methyl isopropylphosphoroamidothioate	Emulsifiable concentrate, or granules	Usual ²	Medium
*DNBP	4, 6-Dinitro-o-sec-butyl phenol	Emulsifiable concentrate, or granules	Usual ²	Very high
		Dust	3.0	Low
DNOSBP	4, 6-Dinitro-o-sec-butyl phenol	Granules	Usual ²	Very high
*Dowfume MC-2	Methyl bromide + chloroicrin (MBR-CP)	Liquid	98	Very high
Endosulfan	6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-9-methano-2,4,3-benzodioxathiepin-3-oxide	Granular	10 to 60	High
		Dust or granules	Below 10	Medium
		Spray, dust, or solution (household use)	Usual ²	Low
*Endothall	7-Oxabicyclo (2.2.1) heptane-2,3-dicarboxylic acid	Solution or granules	Usual ²	High
Endrin	Hexachloroepoxyoctahydro-endo, endo-dimethanonaphthalene	Dust, wettable powder, or emulsifiable concentrate	2.5 and above	Very high
		Dust, wettable powder, emulsifiable concentrate, or bait	Below 2.5	High

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
EPN	O-Ethyl O-p-nitrophenyl phenylphosphonothioate	Dust, emulsifiable concentrate, wettable powder, or granules	Above 2	Very high
		Dust	2 and above	High
		Aerosol (greenhouse use)	10	Very high
EPTC	S-Ethyl N,N-dipropylthiocarbamate	Emulsifiable concentrate, or granules	Usual ²	Medium
Erbon	2-(2,4,5-Trichlorophenoxy) ethyl 2,2-dichloropropionate	Emulsifiable concentrate	Usual ²	Low
Ethion	0,0,0',0' tetraethyl	Wettable powder or emulsifiable concentrate	15 and above	High
		Granules	Below 15	Medium
Ethyl bromide	Ethyl bromide	Liquid	10 and above	Low
Ethylene dibromide	Ethylene dibromide	Liquid	10 and above	Medium
Ethylene dichloride	Ethylene dichloride	Solution	10 and above	Medium
*EXD	Diethyl dithiobis (thionoforimate)	Emulsifiable concentrate	Usual ²	Medium
*Fenac	2,3,6-Trichlorophenylacetic acid	Emulsifiable concentrate, wettable powder, or granules	Usual ²	Medium
Fenson	p-chlorophenyl-benzene-sulfonate	Wettable powder	50 and above	Low
Fenthion	0,0-dimethyl 0-[4—(methylthio)m-tolyl] phosphorothioate	Emulsifiable concentrate	Usual ²	High
Fenuron	3-Phenyl-1,1-dimethylurea	Wettable powder, liquid, or powder	Usual ²	Low
Ferbam	Ferric dimethyl dithiocarbamate	Dust or wettable powder	3 and above	Low
Fluoride: inorganic, water soluble	(Various fluoride compounds)	Powder or liquid	10 and above	High
		Powder or bait	Below 10	Medium

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Folpet	N-trichloromethyl thiophthalimide	Wettable powder or dust	Usual ²	Low
Formaldehyde	Formaldehyde	Solution or dust	4 and above	Very high
*Genite 923	2,4 Dichlorophenyl benzene-sulfonate	Emulsifiable concentrate, wettable powder, or dust	Usual ²	Low
*Guthion	0,0-Dimethyl S-[4-oxo-1,2,3-benzotriazin-3 (4H)-ylmethyl] phosphorodithioate	Emulsifiable concentrate, solution, wettable powder, dust, or granules	Above 2.0	Very high
		Dust	2.0 and below	High
Heptachlor	Heptachloro tetrahydro-4, 7-methanoindene	Emulsifiable concentrate, wettable powder, dust, or granules	10 and above	High
		Dust or granules	Below 10	Medium
		Fertilizer	2.5 or 5.0	Low
Hypochlorites	Sodium and potassium hypochlorites	Solution	10 and above	Medium
I.P.C.	Isopropyl N-phenyl carbamate	Solution	50 and above	Medium
*Kelthane	1,1-bis(Chlorophenyl) 2,2,2-trichloroethanol	Emulsifiable concentrate	Above 25	Medium
		Emulsifiable concentrate, wettable powder, or dust	25 and below	Low
*Kepone	Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta[cd]pentalen-2-one	Wettable powder, dust, or bait	Usual ²	High
Kerosene sprays, and similar formulas containing other petroleum distillates	Kerosene and other petroleum distillates (various formulations)	Liquid	10 and above	Medium ³
KOCN	Potassium cyanate	Wettable powder, crystals, or pellets	Usual ²	Medium
Lead arsenate	Lead arsenate	Wettable powder, or dust	Usual ²	High

¹ Names preceded by an asterisk (*) are trade names.² The percent of concentration in which the product is generally sold or used.³ Low or medium for kerosene alone; high or very high for kerosene-base compounds containing toxic materials.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
*Lethane 384	B-butoxy B'-thiocyano diethyl ether	Emulsifiable concentrate, oil spray, or aerosol	Usual ²	Medium
Lime sulfur	Calcium polysulfide	Liquid, dust	Usual ²	Low
Lindane	Benzene hexachloride (gamma isomer 99% and above)	Wettable powder, dust, solution, or emulsifiable concentrate	25 and above	High
		Dry, for agricultural use. Solution, spray (contact), or emulsifiable concentrate, for household use	Below 25	Medium
Linuron	3-(3,4-Dichlorophenyl)-1-methoxy-1-methylurea	Wettable powder	Usual ²	Low
Malathion	0,0-diethyl dithiophosphate of diethyl mercaptosuccinate	Emulsifiable concentrate or wettable powder	20 and above	Medium
		Emulsifiable concentrate, spray, bait, dust, wettable powder, or aerosol (oil base)	Below 20	Low
Maleic hydrazide	1,2-Dihydropyridazine-3,6-dione	Wettable powder, or liquid	Usual ²	Low
Maneb	Manganese ethylene bis dithiocarbamate	Wettable powder, or dust	Usual ²	Low
*MCPA	2-Methyl-4 chlorophenoxy-acetic acid	Solution (sodium salt), dust, or granules	Usual ²	Low
MCPB	4-(2-Methyl-4-chlorophenoxy) butyric acid	Emulsifiable concentrate, or liquid	Usual ²	Low
Mecoprop	2-(2-Methyl-4-chlorophenoxy) propionic acid	Emulsifiable concentrate	Usual ²	Medium
Mercury compounds: inorganic salts, except calomel	(Mercury compounds)	Solution or soluble powder	20 and above, as mercury	Very high
		Dust	Below 20, as mercury	High
Metaldehyde	Metaldehyde	Bait or dust	Usual ²	High

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Methoxychlor	2,2-Bis (p-methoxyphenyl)-1,1,1-trichloroethane	Wettable powder, emulsifiable concentrate, or dust, or aerosols (household use)	Usual ²	Low
Methyl bromide	Methyl bromide	Liquid	68.6	Very high
Methyl chloride	Methyl chloride	Propellant	Usual ²	Medium
Methylene chloride	Dichloromethane	Technical	Usual ²	Medium
Methyl parathion	0,0-dimethyl 0-p-nitrophenyl thiophosphate	Emulsifiable concentrate, or spray	Above 2.0	Very high
		Dust or emulsifiable concentrate	2.0 and below	High
*Methyl Trithion	0,0-dimethyl S-(p-chlorophenylthio) methyl phosphorodithioate	Dust or emulsifiable concentrate	2.5 to 44.2	High
*MH	1,2-Dihydro-3,6-pyridiazinedione	Wettable powder or emulsifiable concentrate	Usual ²	Low
Mirex	Dodecachlorooctahydro-1,3 4-metheno-2H-cyclobuta [cd] pentalene	Bait	Usual ²	Medium
Molinate	S-ethyl hexahydro-1H azepine-1-carbothioate	Emulsifiable concentrate	71	High
Monolinuron	3-(4-Chlorophenyl)-1-methoxy-1-methylurea	Wettable powder	50	Medium
Monuron	3-(p-chlorophenyl)-1,1-dimethylurea	Wettable powder or granules	Usual ²	Low
*Morestan	6-Methyl-2,2-quinoxalinedithiole cyclic S-S-dithio-carbamate	Wettable powder	25	Medium
*Mylone	Tetrahydro-3,5-dimethyl-2H	Wettable powder	Usual ²	Medium
Nabam	Disodium ethylene bis dithiocarbamate	Liquid	3 and above	Medium
N-1-naphthyl phthalamic acid	N-1-naphthylphthalamic acid	Wettable powder	90	Low
Neburon	1-Butyl-3-(3,4-dichlorophenyl)-1-methylurea	Wettable powder	Usual ²	Low
		Granules	Usual ²	Low

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
*Nemacide (VC-13)	0-2, 4-Dichlorophenyl 0,0-diethyl phosphorothioate	Emulsifiable concentrate	Usual ²	Very high
*Nemafos	0,0-diethyl 0,2-pyrazinyl phosphorothioate	Emulsifiable concentrate or granules	Usual ²	Very high
*Nemagon	1,2-Dibromo-3-chloropropane	Emulsifiable concentrate	Above 10	High
			10 and below	Medium
Nemex	Dichloropropane dichloropropene and chloropierin	Liquid	50/50	Very high
Nicotine and its salts	Nicotine compounds	Solution or spray	5.0 and above	Very high
		Solution or dust	1 to 5.0	High
		Solution	Below 1.0	Medium
		Dust	Below 2.0	Low
N,N-diethyl toluamide	N,N-diethyl toluamide	Liquid	40 and above	Medium
		Spray or dust	Below 40	Low
N-octyl bicycloheptene heptene dicarboximide	N-octal bicycloheptene dicarboximide	Solution or dust	Usual ²	Low
N-Octylsulfoxide of isosafrole	N-octylsulfoxide of isosafrole	Solution, aqueous	Usual ²	Low
		Solution, oil	4.0	
Norea	3-(Hexahydro-4, 7-methanoindan-5-yl)-1,1-dimethylurea	Wettable powder, or granules	Usual ²	Low
Orthodichlorobenzene	Orthodichlorobenzene	Crystals	10 and above	Low
Ovex	p-chlorophenyl p-chlorobenzenesulfonate	Wettable powder	50 and above	Low
		Aerosols (with methyl chloride)	10 and above	High
Paradichlorobenzene	Paradichlorobenzene	Crystals, in vacuum cleaner attachments	Technical	Low
*Paraquat	1,1'-Dimethyl-4,4'-bipyridinium salt (dichloride or bis methylsulfate)	Emulsifiable concentrate	Usual ²	Medium

¹ Names preceded by an asterisk (*) are trade names.² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Parathion	0,0-diethyl 0,p-nitrophenyl thiophosphate	Dust, emulsifiable concentrate, wettable powder, or granules	Above 2.0	Very high
		Dust	2.0 and above	High
		Aerosol (greenhouse use)	10	Very high
Paris green	Copper acetoarsen-ite	Bait, dust, or spray	Technical	See arsenic
*PBA	Polychlorobenzene acid	Liquid	Usual ²	High
p-chlorophenyl phenyl sulfone	p-chlorophenyl phenyl sulfone	Wettable powder	Usual ²	Low
PCP	Pentachlorophenol	Technical, wettable powder, pellets, solution, or flakes	Usual ²	High
PEBC	S-propyl butylethylthiol-carbamate	Emulsifiable concentrate, or granules	Usual ²	Medium
Pebulate	S-propyl butyl-ethylthio-carbamate	Granules	10	Medium
Pentachlorophenol	Pentachlorophenol	Emulsifiable concentrate, wettable powder, granules, crystals, or oil solution	Usual ²	Medium
Peroxyacetic acid	Peracetic acid	Solution	40 and above	High
*Perthane	Diethyl diphenyl dichloroethane (95%) and related reaction products (5%)	Technical, emulsifiable concentrate, wettable powder	Above 25	Medium
		Emulsifiable concentrate or petroleum oil solution, for agricultural and industrial use	25 and below	Low
Phenols	Phenol, cresol, cresylic acid, and others	Liquid	10 and above	High
		Liquid	2 to 10	Medium
Phenyl mercuric acetate	Phenylmercuric acetate	Solution	5 and above	Very high
		Solution	Below 5	High

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Phorate	0,0-Diethyl S-(ethylthio) methyl phosphorodithioate	Granules	5 to 10	Very high
Phosdrin	2-Carbomethoxy-1-methyl-vinyl dimethyl phosphate (alpha isomer) not less than 60% and related compounds not more than 40%	Dust granules	Above 2	Very high
		Dust or aerosol (greenhouse use)	2 and below	High
Phosphamidon	2-Chloro-2-diethylcarbamoyl-1-methylvinyl dimethyl phosphate	Wettable powder, emulsifiable concentrate, or solution	Above 2	Very high
		Dust	2 and below	High
Phosphorus, white or yellow	Phosphorus, white or yellow	Paste	1 and above	Very high
Picloram	4-Amino-3,5,6-trichloropicolinic acid	Emulsifiable concentrate or granules	Usual ²	Medium
Pine oil	Pine oil	Solution	Usual ²	Low
Piperonyl butoxide	Alpha-[2-butoxy-ethoxy ethoxy]-4,5-methylene-dioxy-2-propyltoluene	Dust, wettable powder, spray, or oil solution	Usual ²	Low
*Pival	2-Pivalolyl-1,3-indandione, and salts	Powder or concentrate	Above 3.0	Very high
		Powder or concentrate	0.1 to 3.0	Medium
		Baits	0.025	Low
*P.M.P.	2-Isovaleryl-1,3-indandione, and salts	Powder or concentrate	Above 6.0	Very high
		Powder or concentrate	0.1 to 6.0	Medium
		Bait	0.05 to 0.55	Low
Potassium cyanate	Potassium cyanate	Wettable powder	Usual ²	Medium
Pyrazon	5-Amino-4-chloro-2-phenyl-3- (2H)-pyridazinone	Wettable powder or emulsifiable concentrate	Usual ²	Low
Pyrethrins	Pyrethrins (various compounds)	Dust, ground flowers, or water base spray	0.5 to 2.5	Low
		Spray, kerosene extract, emulsifiable concentrate, or aerosol	Usual ²	Medium

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Quaternary ammonium compounds	Quaternary ammonium compounds	Liquid	10 and above	Medium
			Below 10	Low
Red squill	Red squill	Bait	10	Low
Ronnel	0,0-dimethyl 0-(2,4,5-trichlorophenyl) phosphorothioate	Emulsifiable concentrate, wettable powder, dust, spray aerosol, oil solution, or bait	Usual ²	Medium
		Dry, in feed supplement	Usual ²	Low
Rotenone	Rotenone (plant derivative)	Wettable powder, dip, dust, or emulsifiable concentrate	Usual ²	Low
Ryania	Ryania speciosa	Dust	Usual ²	Low
Sabadilla powder	Sabadilla powder (plant derivative)	Liquid or dust	Usual ²	Low
Sesamin	2,6-bis(3,4-methylene-dioxyphenyl)-3,7-dioxabicyclo [3,3,0] octane	Solution	Usual ²	Low
*Sesone	Sodium 2,4-dichlorophenoxyethyl sulfate	Wettable powder	90	Medium
Shell Compound 4072	2-Chloro-1-(2,4-dichlorophenyl) vinyl diethyl phosphate	Emulsifiable concentrate, or granules	Usual ²	High
Siduron	1-(2-Methylcyclohexyl)-3-phenylurea	Wettable powder, or fertilizer	Usual ²	Low
Silvex	2-(2,4,5-Trichlorophenoxy) propionic acid	Emulsifiable concentrate	Usual ²	Low
Simazine	2-Chloro-4,6-bis (ethyl-amino)-5-triazine	Wettable powder, or granules	Usual ²	Low
Sodium isopropyl xanthate	Sodium isopropyl xanthate	Wettable powder	Usual ²	Low
Sodium trichloroacetate	Sodium trichloroacetate	Granules (pellets), wettable powder, or emulsifiable concentrate	Usual ²	Low
Sorbic acid	2, 4-Hexadienoic acid	Technical	99	Low

¹ Names preceded by an asterisk (*) are trade names.² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
*Strobane	Terpene polychlorinates (chlorinated mixture of camphene and related terpenes containing 65 to 69%)	Emulsifiable concentrate dry, wettable powder, dust, or oil solution	25 and above	High
		Self propelled spray	0.5 to 6.0	Low
Strychnine and its salts (sulfate)	Strychnine and its salts (various formulations)	Technical powder tablet, bait	Usual ²	Very high
Sulfur	Sulfur	Wettable powder, or dust	Usual ²	Low
*Sulphenone	p-Chlorophenyl phenyl sulfone	Wettable powder	Usual ²	Low
2,4,5-T	2,4,5-Trichlorophenoxy-acetic acids, and inorganic salts or 2,4,5-Trichlorophenoxy-acetic acid, organic and amine salts	Emulsifiable concentrate, wettable powder, granules, or dust	Usual ²	Low
Tartar emetic	Antimony potassium tartrate	(A protective ingredient in zinc phosphide arsenic or thallium products)	Usual ²	Medium
*TCA	Trichloroacetic acid	Emulsifiable concentrate	Usual ²	Low
TDE	1,1-Dichloro-2, 2-bis (p-chlorophenyl) ethane	Emulsifiable concentrate, wettable powder or dust	Usual ²	Medium
1080 (Ten eighty)	Sodium fluoracetate	Concentrate or bait	Usual ²	Very high
Tepp	Tetraethyl pyrophosphate	Emulsifiable concentrate dust, spray, bait, or aerosol	1 and above	Very high
		Dust	Below 1	High
Tetradifon	p-Chlorophenyl 2,4,5-trichlorophenyl sulfone	Wettable powder	25 and 50	Low
Tetraethyl dithionopyrophosphate	Tetraethyl dithionopyrophosphate	Bait or aerosol	1 and above	Very high
			Below 1	High
*Thanite	Isobornyl thiocynoacetate	Emulsifiable concentrate, wettable powder, or dust	Usual ²	Low

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

Table 2.—Relative toxicities of agricultural and household pesticides—Continued

Commonly used name ¹	Chemical name	Formulation	Percent of concentration	Toxicity to humans
Thiram	Tetramethyl thiuram disulfide	Dust or wettable powder	20 and above	Low
Toxaphene	Chlorinated camphene containing 67 to 69% chlorine	Dust or wettable powder	25 and above	High
		Dust or granules	Below 25	Medium
Trialate	S-2, 3, 3-Trichloroallyl N,N-disopropylthiol carbamate	Emulsifiable concentrate	10 and above	Medium
Trichlorofon	Dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate	Technical	90 to 99	High
		Wettable powder or dust	Usual ²	Medium
Vernolate	S-Propyl dipropylthio-carbamate	Emulsifiable concentrate	Usual ²	Medium
Warfarin	3-(Alpha-acetonylbenzyl) 4-hydroxycoumarin	Technical	Above 3	Very high
		Powder	0.1 to 3.0	High
		Bait	0.025	Low
*Zectran	4-Dimethylamino 3,5-xylyl methylcarbamate	Emulsifiable concentrate or wettable powder	Usual ²	High
Zinc phosphide	Zinc phosphide	Powder	10 and above	Very high
		Paste	2 to 10	High
		Bait	Below 2	Medium
Zinc salts (considered as zinc, not as anions)	Zinc salts (various compounds)	Solution	5 and above, as zinc	Medium
Zineb	Zinc ethylene bis (dithiocarbamate)	Wettable powder	10 and above	Low
Zinophos	0,0-Diethyl 0,2-pyrazinyl phosphorothioate	Emulsifiable concentrate, or granules	Usual ²	Very high
Ziram	Zinc dimethyl dithiocarbamate	Dust or spray	3 and above	Low

¹ Names preceded by an asterisk (*) are trade names.

² The percent of concentration in which the product is generally sold or used.

CHEMICAL AND COMMONLY USED NAMES OF AGRICULTURAL AND HOUSEHOLD PESTICIDES

[Listing of chemical names is alphabetical; numerals are disregarded]

If you know only the chemical name of a product, look opposite it in this list to find the *commonly used* name. If you know the commonly used name and wish to find the chemical name, refer to the first two columns in table 2, pp. 41 to 58.

<i>Chemical name</i>	<i>Commonly used name</i>	<i>Chemical name</i>	<i>Commonly used name</i>
Acetone	Acetone	Benzene	Benzene
Acrylonitrile	Acrylonitrile	Benzene hexachloride (gamma isomer 99% and above)	Lindane
Allyl homolog of cinerin I	Allethrin	1,1-Bis (chlorophenyl) 2,2,2-trichloroethanol	Kelthane
3-(Alpha-acetonylbenzyl) 4-hydroxycoumarin	Warfarin	2,6-Bis(3,4-methylene- dioxyphenyl)-3,7- dioxabicyclo [3,3,0] octane	Sesamin
Alpha-[2-butoxy-ethoxy ethoxy]-4,5-methyl- enedioxy 2-propyltoluene	Piperonyl butoxide	2,2-Bis (p-methoxy- phenyl)-1,1,1-trichloro- ethane	Methoxychlor
Alpha naphthyl thiourea	Alpha naphthyl thiourea	1,3-Bis(2,2,2-tri-chloro- 1-hydroxyethyl) urea	DCU
5-Amino-4-chloro-2- phenyl-3-(2H)- pyridazinone	Pyrazon	Boric acid	Boric acid
3-Amino-2,5- dichlorobenzoic acid	Amiben	5-Bromo-3sec-butyl-6- methyluracil	Bromacil
3-Amino-1,2,4-triazole	Amitrole	1-Butyl-3(3,4-dichlor- ophenyl)- 1-methylurea	Neburon
4-Amino-3,5,6-trichloro- picolinic acid	Picloram	(Cadmium compounds)	Cadmium
Ammonium nitrate	Ammonium nitrate	Calcium arsenate	Calcium arsenate
Ammonium sulfamate	Ammonium sulfamate; AMS	Calcium cyanamide	Cyanamid
Antimony potassium tartrate	Tartar emetic	Calcium cyanide	Cyanide calcium
Arsenic acid	Arsenite desiccant	Calcium polysulfide	Lime sulfur
Arsenic compounds, in- organic insoluble (various compounds)	Arsenic compounds, inorganic insoluble	Calcium propylarsonate	Arsonates, calcium propyl
Arsonates, except calcium propyl arsonate (various compounds)	Arsonates, except calcium propyl arsonate		
B-butoxy B'-thiocyano diethyl ether	Lethane 384		

Chemical and commonly used names of agricultural and household pesticides—Continued

<i>Chemical name</i>	<i>Commonly used name</i>
2-Carbomethoxy-1-methylvinyl dimethyl phosphate (alpha isomer) not less than 60% and related compounds not more than 40%	Phosdrin
Carbon disulfide	Carbon disulfide
Carbon tetrachloride	Carbon tetrachloride
Chlorates (various compounds)	Chlorates, including magnesium and sodium salts
Chlorinated camphene containing 67 to 69% chlorine	Toxaphene
2-Chloroallyl diethyl-dithiocarbamate	CDEC
2-Chloro-4,6-bis (ethylamino)-s-triazine	Simazine
4-Chloro-2-butynyl m-chlorocarbanilate	Barban
2-Chloro-1-(2,4-dichlorophenyl) vinyl diethyl phosphate	Shell Compound 4072
2-Chloro-2-diethylcarbamoyl-1-methylvinyl dimethyl phosphate	Phosphamidon
2-Chloro-4-ethylamino-6-isopropylamino-s-triazine	Atrazine
Chloroform	Chloroform
2-Chloro-N,N-diallyl-acetamide	CDAA
3-(4-Chlorophenyl)-1-methoxy-1-methylurea	Monolinuron
Chloropropene (mixed)	Chloropropene (mixed)
Citronella, oil of	Citronella, oil of
Copper acetoarsenite	Paris green

<i>Chemical name</i>	<i>Commonly used name</i>
Copper compounds (various formulations)	Copper compounds
(Cyanide compounds, inorganic)	Cyanide, inorganic
Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta[cd] pentalen-2-one	Kepone
1,2-Dibromo-3-chloropropane	Nemagon
1,2-Dibromo-2,2-dichloroethyl dimethyl phosphate	Dibrom
Dibutyl succinate	Dibutyl succinate
2,6-Dichlorobenzonitrile	Dichlobenil
1,1-Dichloro-2,2-bis (p-chlorophenyl) ethane	TDE
Dichlorodiphenyl-dichlorethane	DDD
Dichlorodiphenyl-trichloroethane	DDT
Dichloroethyl ether	Dichloroethyl ether
Dichloromethane	Methylene chloride
3',4'-Dichloro-2-methylaniline	Dicryl
2,3-Dichloro-1,4-naphthoquinone	Dichlone
2,4-Dichlorophenoxy-acetic acid and inorganic salts or 2,4-Dichlorophenoxy-acetic acid, organic esters, and amine salts	2,4-D
2,4-Dichlorophenyl benzene sulfonate	Genite 923
3-(3,4-Dichlorophenyl)-1,1-dimethylurea	Diuron
2,4-Dichlorophenyl ester of benzene sulfonic acid	2,4-Dichlorophenylester of benzene sulfonic acid

Chemical and commonly used names of agricultural and household pesticides—Continued

<i>Chemical name</i>	<i>Commonly used name</i>	<i>Chemical name</i>	<i>Commonly used name</i>
Dichloropropane dichloropropene and chloropicrin	Nemex	4,6-Dinitro-o-cresol	Dinitrocresol
Dichloropropene dichloropropane and related C ₃ hydrocarbons	DD-Mixture	4,6-Dinitro-o-sec-butyl phenol	DNBP; DNOSBP
2,2-Dichloropropionic acid and salts	Dalapon and salts	Di-n-propyl maleate isosafrol condensate (n-propyl isomer)	Di-n-propyl maleate isosafrol condensate (n-propyl isomer)
2,2-Dichlorovinyl dimethyl phosphate	Dichlorovos; DDVP	Diphenylacetonitrile	Diphenatrile
Diethyl diphenyl dichloroethane (95%) and related reaction products (5%)	Perthane	3-Diphenylacetyl-1,3- indandione and salts	Diphacinone
Diethyl dithiobis (thionoformate)	EXD	Diphenylamine	Diphenylamine
6,7-Dihydrodi-pyrido (1,2-2:2',1'-C) pyrazidinium salt	Diquat	Disodium ethylene bis dithiocarbamate	Nabam
1,2-Dihydropyridazine-3, 6-dione	Malic hydrazide	Dodecachlorooctahydro- 1,3,4-metheno-2H- cyclobuta [cd] pentalene	Mirex
1,2-Dihydro-3, 6-pyridiazinedione	MH	Ethyl bromide	Ethyl bromide
4-Dimethylamino 3,5- xylyl methylcarbamate	Zectran	Ethyl 4,4'-dichloro- benzilate	Chlorobenzilate
Dimethylarsinic acid	Cacodylic acid	Ethylene dibromide	Ethylene dibromide
1,1'-Dimethyl-4,4'- bipyridinium salt (dichloride or bis methylsulfate)	Paraquat	Ethylene dichloride	Ethylene dichloride
Dimethyl phosphate of alphamethylbenzyl-3- hydroxy-cisecrotonate	Ciodrin	Ferric dimethyl dithiocarbamate	Ferbam
Dimethyl phosphate of 3-hydroxy N,N-di- methyl-cisecrotonamide	Bidrin	Formaldehyde	Formaldehyde
Dimethyl-tetrachloro- terephthalate	DAC; DCPA	Heptachloro tetrahydro- 4,7-methanoindene	Heptachlor
Dimethyl (2,2,2-trichloro- 1-hydroxyethyl) phosphonate	Trichlorofon	Hexachloro epoxy ester of benzene sulfonic acid	Dieldrin
		Hexachloro hexahydro- endo exodimethano- naphthalene (95%)	Aldrin
		6,7,8,9,10,10-Hexachloro- 1,5,5a,6,9,9a-hexa- hydro-9-methano-2,4,3- benzodioxathiepin-3- oxide	Endosulfan
		Hexachloroepoxyocta- hydroendo, endo- dimethanonaphthalene	Endrin

Chemical and commonly used names of agricultural and household pesticides—Continued

<i>Chemical name</i>	<i>Commonly used name</i>	<i>Chemical name</i>	<i>Commonly used name</i>
2,4-Hexadienoic acid	Sorbic acid	2-(2-Methyl-4-chloro-phenoxy) propionic acid	Mecoprop
3-(Hexahydro-4,7-methanoindan-5-yl)-1,1-dimethylurea	Norea	1-(2-Methylcyclohexyl)-3-phenylurea	Siduron
Isobornyl thiocyanacetate	Thanite	6-Methyl-2,2-quinoxalinedithiolcyclic S-S-dithio-carbamate	Morestan
Isopropyl N-(3-chlorophenyl)carbamate	CIPC	1-Naphthyl N-methyl-carbamate	Carbaryl, Sevin
Isopropyl N-phenyl carbamate	I.P.C.	N-Butyl-N-ethyl-alpha, alpha, alpha-trifluoro-2,6-dinitro-p-toluidine	Benefin
2-Isovaleryl-1,3-indandione, and salts	P.M.P.	Nicotine compounds	Nicotine and its salts (sulfate)
Kerosene and other petroleum distillates (various formulations)	Kerosene sprays, and similar formulas containing other petroleum distillates	2-Nitro-1,1-bis(p-chlorophenyl) butane or 2-Nitro-1,1-bis(p-chlorophenyl) propane or Mixtures of the above	Dilan
Lead arsenate	Lead arsenate	N-1-Naphthyl phthamic acid	N-1-Naphthyl phthamic acid
Manganese ethylene bis dithiocarbamate	Maneb	N,N-Diethyl toluamide	N,N-Diethyl toluamide
(Mercury compounds)	Mercury compounds: inorganic salts, except calomel	N,N-Dimethyl-2,2-diphenylacetamide	Diphenamid
Metaldehyde	Metaldehyde	N-Octyl bicycloheptene dicarboximide	N-Octyl bicycloheptene dicarboximide
2-Methoxy-3,6-dichlorobenzoic acid 3,6-Dichloro-o-anisic acid	Dicamba	N-Octylsulfoxide of isosafrole	N-Octylsulfoxide of isosafrole
Methyl bromide	Methyl bromide	N-Trichloromethylthio-4-cyclohexene-1,2-dicarboximide	Captan
Methyl bromide + chloropicrin	Dowfume MC-2	N-(trichloromethyl thio) phthalimide	Folpet
Methyl bromide + chloropicrin in petroleum solvent	Brozone	Octachloro-4, 7-methano tetrahydroindane (60%)	Chlordane
Methyl chloride	Methyl chloride	0-2,4-Dichlorophenyl 0,0-diethyl phosphorothioate	Nemacide (VC-13)
2-Methyl-4 chlorophenoxyacetic acid	MCPA		
4-(2-Methyl-4-chlorophenoxy) butyric acid	MCPB		

Chemical and commonly used names of agricultural and household pesticides—Continued

<i>Chemical name</i>	<i>Commonly used name</i>	<i>Chemical name</i>	<i>Commonly used name</i>
0-(2,4-Dichlorophenyl) 0-methyl isopropyl- phosphoroamidothioate	DMPA	0,0-Dimethyl S-[4-oxo- 1,2,3-benzotriazin-3 (4H)-yl-methyl] phosphorodithioate	Guthion
O-Ethyl O-p-nitrophenyl phenylphosphonothioate	EPN	0,0-Dimethyl S-(p- chlorophenylthio) methyl phosphoro- dithioate	Methyl trithion
0,0-Diethyl dithiophos- phate of diethyl mercaptosuccinate	Malathion	0,0,0',0' Tetraethyl S,S'-methylene bis- phosphorodithioate	Ethion
0,0-Diethyl 0-(and S-) 2-(ethylthio)ethyl phosphorothioates	Demeton	Orthodichlorobenzene	Orthodichlorobenzene
0,0-Diethyl 0,3-chloro-4- methyl-2-oxo-2H-1- benzopyran-7yl phos- phorothioate	Coumaphos	7-Oxabicyclo (2,2,1) heptane-2,3- dicarboxylic acid	Endothall
0,0-Diethyl 0-(2-isopro- pyl-6-methyl-4-pyri- midinyl) phosphoro- thioate	Diazinon	Paradichlorobenzene	Paradichlorobenzene
0,0-Diethyl 0,p-nitro- phenyl thiophosphate	Parathion	p-chlorobenzyl p- chlorophenyl sulfide	Chlorbenside
0,0-Diethyl 0,2-pyrazinyl phosphorothioate	Cynem; Nemafos; Zinophos	3-[p-(chlorophen-oxy)- phenyl]-1,1-dimeth- ylurea	Chloroxuron
0,0-Diethyl S-[2-(ethyl- thio) ethyl] phosphoro- dithioate	DiSyston	p-chlorophenyl-benzene- sulfonate	Fenson
0,0-Diethyl S-(ethylthio) methyl phosphoro- dithioate	Phorate	3-(p-chlorophenyl)-1,1- dimethylurea	Monuron
0,0-Dimethyl 0-[4-(meth- ylthio) m-tolyl] phosphorothioate	Fenthion	p-chlorophenyl p-chloro benzenesulfonate	Ovex
0,0-Dimethyl 0-p-nitro- phenyl thiophosphate	Methyl parathion	p-chlorophenyl phenyl sulfone	Sulphenone
0,0-Dimethyl 0-(2,4,5- trichlorophenyl) phosphorothioate	Ronnel	p-chlorophenyl 2,4,5- trichlorophenyl sulfone	Tetradifon
		Pentachlorophenol	PCP
		Peracetic acid	Peroxyacetic acid
		Phenol, cresol, cresylic acid, and others	Phenols
		3-Phenyl-1,1-dimethylurea	Fenuron
		Phenyl mercuric acetate	Phenyl mercuric acetate
		Phosphorus, white or yellow	Phosphorus, white or yellow

Chemical and commonly used names of agricultural and household pesticides—Continued

<i>Chemical name</i>	<i>Commonly used name</i>	<i>Chemical name</i>	<i>Commonly used name</i>
Pine oil	Pine oil	Sodium fluoaluminate	Cryolite
2-Pivalyl-1,3-indandione, and salts	Pival	Sodium fluoracetate	1080 (Ten eighty)
Polychlorobenzoic acid	PBA	Sodium isopropyl xanthate	Sodium isopropyl xanthate
Potassium cyanate	Potassium cyanate; KOCN	Sodium trichloroacetate	Sodium trichloroacetate
2-Propenal	Acrolein	S-[(p-chlorophenylthio) methyl] 0,0-diethyl phosphorodithioate	Carbophenothion
2-Propene-1-ol	Allyl alcohol	S-propyl butylethylthiol carbamate	PEBC
2-(p-tertiary-butylphenoxy) isopropyl-2-chloroethyl sulfite	Aramite	S-propyl dipropylthiocarbamate	Vernolate
Pyrethrins (various compounds)	Pyrethrins	S-2,3,3-trichloro-allyl N, N-disopropylthiol carbamate	Triallate
Quaternary ammonium compounds	Quaternary ammonium compounds	Strychnine and its salts (various formulations)	Strychnine and its salts (sulfate)
Red squill	Red squill	Sulfur	Sulfur
Rotenone (plant derivative)	Rotenone	Terpene polychlorinates (chlorinated mixture of campene and related terpenes containing 65 to 69% chlorine)	Strobane
Ryania speciosa	Ryania	Tetraethyl dithionopyrophosphate	Sulfotep
Sabadilla powder (plant derivative)	Sabadilla powder	Tetraethyl pyrophosphate	Tepp
S-2,3-Dichloroallyl N,N-diisopropyl-thiolcarbamate	DATC; CP 15336; Diallate	Tetrahydro-3,5-dimethyl-2H	Mylone
2-sec-butyl-4,6-dinitrophenyl 3-methyl-2-butenolate	Binapaeryl	Tetramethyl thiuram disulfide	Thiram
S-ethyl hexahydro-1H-azepine-1-carbothioate	Bensulide; Molinate	Thallium sulfate (various compounds)	Thallium sulfate
S-ethyl N,N-dipropylthiocarbamate	EPTC	Tributylphosphorotriothioate	Def
Sodium and potassium hypochlorites	Hypochlorites	Trichloroacetic acid	TCA
Sodium 2,4-dichlorophenoxyethyl sulfate	Sesone		

Chemical and commonly used names of agricultural and household pesticides—Continued

<i>Chemical name</i>	<i>Commonly used name</i>	<i>Chemical name</i>	<i>Commonly used name</i>
2,4,5-Trichlorophenoxy- acetic acids, and in- organic salts or	2,4,5-T	2,3,6-Trichlorophenyl- acetic acid	Fenac
2,4,5-Trichlorophenoxy- acetic acid, organic and amine salts		Trichlorophenyl sulfone	Chloropicrin
2-(2,4,5-Trichlorophe- noxy) ethyl 2,2-dichloro- propionate	Erbon	Zinc dimethyl dithiocar- bamate	Ziram
2-(2,4,5-Trichlorophe- noxy) propionic acid	Silvex	Zinc ethylene bis (dithiocarbamate)	Zineb
		Zinc phosphide	Zinc phosphide
		Zinc salts (various compounds)	Zinc salts (considered as zinc, not as anions)

Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

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Use Pesticides Safely

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